

No. 23-1922

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**In the  
United States Court of Appeals  
for the Federal Circuit**

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BEARBOX LLC, AUSTIN STORMS,

*Plaintiffs-Appellants,*

v.

LANCIUM LLC, MICHAEL T. McNAMARA, RAYMOND E. CLINE, JR.,

*Defendants-Appellees.*

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Appeal from the United States District Court  
for the District of Delaware, No. 1:21-cv-00534-GBW-CJB  
The Honorable Gregory B. Williams

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**BRIEF OF PLAINTIFFS-APPELLANTS  
BEARBOX LLC and AUSTIN STORMS**

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## PATENT CLAIMS

The following claims of U.S. Patent No. 10,608,433 are illustrative of the issues raised in this appeal.

1. A system comprising:
  - a set of computing systems, wherein the set of computing systems is configured to perform computational operations using power from a power grid;
  - a control system configured to:
    - monitor a set of conditions;
    - receive power option data based, at least in part, on a power option agreement, wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;
    - responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions, wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and
    - provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.
16. The system of claim 1, wherein the set of conditions monitored by the control system further comprise:
  - a price of power from the power grid; and
  - a global mining hash rate and a price for a cryptocurrency; andwherein the control system is configured to:
  - determine the performance strategy for the set of computing systems based on a combination of at the portion of the power option data, the price of power from the power grid, the global mining hash rate and the price for the cryptocurrency,wherein the performance strategy specifies for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

FORM 9. Certificate of Interest

Form 9 (p. 1)  
March 2023

**UNITED STATES COURT OF APPEALS  
FOR THE FEDERAL CIRCUIT**

**CERTIFICATE OF INTEREST**

**Case Number** 2023-1922

**Short Case Caption** BearBox LLC v. Lancium LLC

**Filing Party/Entity** Plaintiffs-Appellants BearBox LLC and Austin Storms

**Instructions:**

1. Complete each section of the form and select none or N/A if appropriate.
2. Please enter only one item per box; attach additional pages as needed, and check the box to indicate such pages are attached.
3. In answering Sections 2 and 3, be specific as to which represented entities the answers apply; lack of specificity may result in non-compliance.
4. Please do not duplicate entries within Section 5.
5. Counsel must file an amended Certificate of Interest within seven days after any information on this form changes. Fed. Cir. R. 47.4(c).

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Date: 08/25/2023

Signature: /s/ Benjamin T. Horton

Name: Benjamin T. Horton

## FORM 9. Certificate of Interest

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March 2023

<b>1. Represented Entities.</b> Fed. Cir. R. 47.4(a)(1).	<b>2. Real Party in Interest.</b> Fed. Cir. R. 47.4(a)(2).	<b>3. Parent Corporations and Stockholders.</b> Fed. Cir. R. 47.4(a)(3).
Provide the full names of all entities represented by undersigned counsel in this case.	Provide the full names of all real parties in interest for the entities. Do not list the real parties if they are the same as the entities.  <input checked="" type="checkbox"/> None/Not Applicable	Provide the full names of all parent corporations for the entities and all publicly held companies that own 10% or more stock in the entities.  <input checked="" type="checkbox"/> None/Not Applicable
BearBox LLC		
Austin Storms		

☐ Additional pages attached



## FORM 9. Certificate of Interest

Form 9 (p. 3)  
March 2023

**4. Legal Representatives.** List all law firms, partners, and associates that (a) appeared for the entities in the originating court or agency or (b) are expected to appear in this court for the entities. Do not include those who have already entered an appearance in this court. Fed. Cir. R. 47.4(a)(4).

☐ None/Not Applicable

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Marshall Gerstein & Borun:		
John J. Lucas		
Ashby & Geddes:		
Andrew C. Mayo		

**5. Related Cases.** Other than the originating case(s) for this case, are there related or prior cases that meet the criteria under Fed. Cir. R. 47.5(a)?

☐ Yes (file separate notice; see below) ☒ No ☐ N/A (amicus/movant)

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**6. Organizational Victims and Bankruptcy Cases.** Provide any information required under Fed. R. App. P. 26.1(b) (organizational victims in criminal cases) and 26.1(c) (bankruptcy case debtors and trustees). Fed. Cir. R. 47.4(a)(6).

☒ None/Not Applicable

☐ Additional pages attached


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### **STATEMENT OF RELATED CASES**

No other appeal in or from the same civil action or proceeding in the district court was previously before this Court or any other appellate court. Counsel is not aware of any case pending in this Court or any other court or agency that will directly affect or be directly affected by this Court's decision in the pending appeal other than the underlying district court case from which this appeal is taken.



## **JURISDICTIONAL STATEMENT**

This is an appeal from an action seeking correction of the named inventors of a United States patent under 35 U.S.C. § 256 and related state-law claims. The district court had subject-matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a) because the inventorship claims arise under federal patent law. The district court had supplemental jurisdiction over the related state-law claims under 28 U.S.C. § 1367 because those claims form part of the same case or controversy.

The district court issued its Final Judgment on April 5, 2023, disposing of all claims. Appx60-62. Plaintiffs-Appellants timely filed a Notice of Appeal on May 4, 2023. Appx7973-7974.

This Court has appellate jurisdiction under 28 U.S.C. § 1295(a)(1).

## **STATEMENT OF THE ISSUES**

### **Issue 1: Conversion Is Not Preempted by Patent Law**

Did the district court err in dismissing BearBox's conversion claim as preempted by federal patent where BearBox's conversion claim is not based on conduct that is protected by federal patent law and is independent of any patent inventorship determination?

### **Issue 2: Striking a Supplemental Expert Report was an Abuse of Discretion**

Did the district court abuse its discretion in issuing the extreme sanction of striking the supplemental expert report of BearBox's expert Dr. McClellan in its entirety where he offered that supplement to synthesize his existing opinions with the district court's claim construction order resolving a dispute Lancium raised only after the close of expert discovery?

### **Issue 3: Flawed Analysis of Conception and Corroboration**

Did the district court err in its consideration of Storms' story, the corroborating evidence, and the claims, where the district court excluded testimony about what Storms communicated to the defendants and focused on independent claim elements and individual documents rather than combinations of elements and corroborating evidence taken together as a whole?

## **STATEMENT OF THE CASE**

### **A. Summary of proceedings before the district court**

BearBox appeals the district court's final judgment denying its claims for correction of inventorship seeking to name Austin Storms an inventor of the '433 patent, and from the district court's summary judgment order finding BearBox's conversion claim preempted by federal patent law.

BearBox alleged that Storms conceived the claimed inventions in "late 2018 and early 2019." At trial, the district court received evidence of 20 source code files, 27 drawings and diagrams, 11 photographs of system components, and three sets of whiteboard notes, all with metadata time stamps of late 2018 to early 2019, before Lancium's earliest purported conception date of August 2019 to October 2019. Appx7132 ¶¶1-11, Appx8842-8878.

BearBox further alleged Storms communicated his inventions to Lancium during a May 3, 2019 dinner with Lancium's CEO and CFO following a Bitcoin conference. The CEO, Michael McNamara, expressed interest, later asking Storms to send details about his system, which Storms provided on May 9, 2019, emailing a system diagram ("Diagram"), specification ("Spec Sheet"), and modeled data set ("Data File"). Appx192-266, Appx623-713, Appx1631-1734. In October 2019, Lancium filed a provisional patent application that would mature into the '433 patent without naming Storms as an inventor. BearBox also alleged that Lancium

converted BearBox documents describing aspects of BearBox’s technology and used those documents without authorization to modify Lancium’s software, using and licensing that software for profit, as well as obtaining \$150 million in outside investments based on Lancium’s possession and use of the modified software.

## **B. The ’433 Patent**

United States Patent No. 10,608,433 (“the ’433 patent”) is titled “Methods and Systems for Adjusting Power Consumption Based on a Fixed Duration Power Option Agreement,” and was issued by the United States Patent and Trademark Office (“USPTO”) on March 31, 2020. The ’433 patent lists Michael McNamara and Raymond Cline, Jr. as the inventors. The ’433 patent issued from United States Patent Application No. 16/702,931, which was filed on December 4, 2019. Appx6216 ¶7, Appx101. The ’433 patent claims priority to United States Provisional Patent Application No. 62/927,119, which was filed on October 28, 2019. D.I. 262 at ¶¶ 15-16.

The ’433 patent relates to a set of computing systems, e.g. a load, that are configured to perform computational operations, e.g. Bitcoin mining, using power from a power grid. Appx121(5:48-49). The ’433 patent teaches a control system that monitors a set of conditions like cryptocurrency prices, global hash rate, and the price of electricity, and receives power option data that is based, at least in part, on a power option agreement between a power entity and a load, which specifies

minimum power thresholds associated with time intervals. The '433 patent teaches determining a performance strategy for a load based on a combination of the power option data and one or more monitored conditions. The performance strategy may specify power consumption targets for the load for each time interval such that each power consumption target is equal to or greater than the minimum power threshold associated with each time interval. Appx6 ¶¶16-17.

The '433 patent specification further describes a “wind farm” as an example of a “power entity” subject to a power option agreement required to deliver power to a load. Appx143(50:22-35) (“a wind generation farm may enter into the power option agreement”). And a load may be a set of computing systems (e.g. a Bitcoin miner or group of Bitcoin miners). In addition, the '433 patent says a remote master control system “may control a load (e.g., a set of computing systems) in accordance with power thresholds and time intervals received from the power entity based on the power option agreement.” Appx145(54:55-61). The '433 patent further describes loads located “near a wind farm,” and wind farms with loads co-located on site. Appx123-133(9:64-30:2), Appx137(38:39-43).

### **C. BearBox, Austin Storms, cryptocurrency mining, and the grid**

In 2017, Storms designed and built a half-megawatt datacenter for Bitcoin mining in Mandeville, Louisiana, but Storms’ implementation became unprofitable due to the price of electricity. Appx9 ¶27. By late-2018, Storms began developing

shipping containers that would house Bitcoin miners, with the intention that such containers could be placed anywhere and be controlled remotely. Appx8017-8018(47:14-52:4). Storms' development (the "BearBox System") led to the founding of BearBox LLC. Appx9-10 ¶28. Through late-2018 into early 2019, Storms began to design, build, and test a system of relays, power distribution units ("PDUs"), and an interface that allowed a remote user to control individual relays so that miners could be turned on and off. Appx10 ¶29.

Storms introduced evidence that he conceived of the BearBox System as holding up to 272 Bitcoin miners, with "relay mapping" for "full automation," and a maximum power consumption of 373 kilowatts ("kW"). Appx24-25 ¶75. Storms source code files include an equation calculating total power consumed by multiplying the power consumption of a single miner (e.g. 1.3 kW) by the number of miners turned on (e.g. 272). Appx9110 ("kW\_load = 1.3 \* 272 \* 1.05").

BearBox introduced evidence of a graphic interface Storms developed showing that individual miners (e.g. "Relay 1"), banks of 4 miners (e.g. "All 1-4"), or "all" miners, could be set to "on" or "off." Appx9414-9415. Storms said this "allows you to control individual relays on the relay controller to turn miners on and off remotely." Appx8017(49:13-25). BearBox also introduced evidence of a graphic interface showing Storms' concept with 2 miners turned off while 22 other miners were turned on. Appx9418-9419, Appx8018(50:21-51:3).

The electrical grid is an interconnected system of generators, transmitters, and consumers that must be managed to ensure reliability. Appx8050(180:8-25). A consumer of electricity is called a “load.” Appx8050(181:1-6). A manager of an electrical grid is called an “independent system operator,” or “ISO.” Appx8050(181:15-25). ISOs manage the electrical grid by creating and managing energy markets to ensure a balance between supply and consumption (by the load) of power. Appx8052(188:7-189:19), Appx8057(206:7-10, 207:16-20), Appx8 ¶23.

The Electric Reliability Council of Texas (“ERCOT”) is an ISO that operates a day-ahead energy market (“DAM”) for buyers and sellers of energy. Appx8056 (202:8-11), Appx8056(202:18-20). If a load buys energy in the DAM, it must pay for that energy, but it does not have to use that energy. Appx8056(203:4-24). Instead, the load could sell that power in the real-time energy market (“RTM”), which is called “sell-back.” Appx8056(203:15-20), Appx8056(203:25-204:13), Appx8 ¶24. A qualified scheduling entity (“QSE”) is required to act as an intermediary between ERCOT and a load to facilitate all energy transactions. Appx8052-8053(189:24-190:13), Appx8053(192:6-11), Appx9 ¶25.

### **1. Storms’ inspiration, idea, and simulation**

Around November 26, 2018, Storms met Benjamin Hakes, a representative at GlidePath, through Twitter. GlidePath is a wind farm developer. Storms and Hakes discussed how GlidePath might be interested in a system that mined

cryptocurrency using wind energy when electricity prices are low but sold wind energy to the grid when prices were high. Appx10 ¶30.

They discussed “behind-the-meter” applications, Appx13450, which is a load connected directly to a power generation entity (*e.g.*, a wind farm), which supplies power directly to the load without first transmitting that power to the grid, Appx8116 (439:17-440:1). Between November 2018 and April 2019, they discussed locational margin price (“LMP”), power purchase agreement (“PPA”), and day-ahead price. Appx8943-8944. LMP correlates to the price that a wind farm receives for selling power in a specific location, Appx8943, which is shorthand for the price of power. Appx10 ¶31.

Storms wrote more code to modify his BearBox System and brainstormed functionality on whiteboards. Appx10-11 ¶¶32-33.

Storms testified:

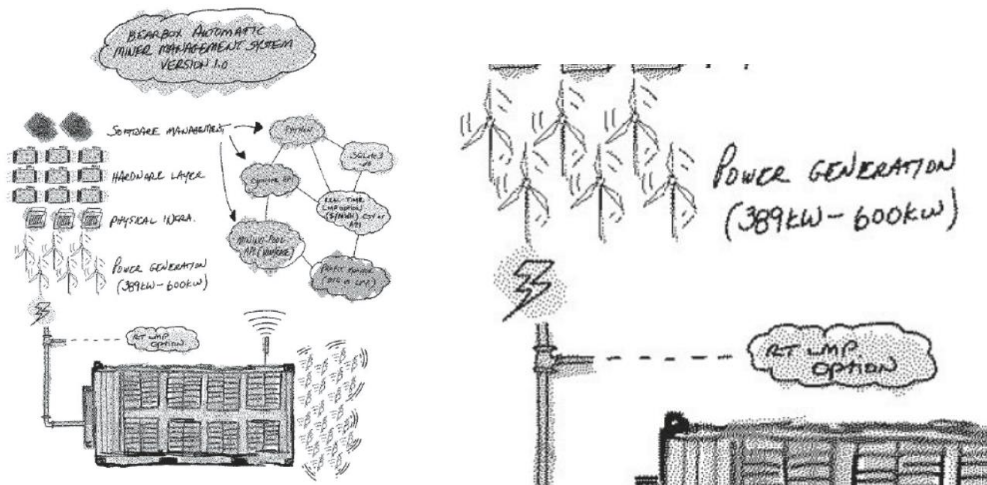
So I wanted to talk to [Hakes] about the LMP check, because I thought that there was a way that I figured out [the profitability] of mining with the LMP logic over a week or so versus just selling power at the LMP.

So you could dynamically compare the two and that realistically the model that I was working on at the time would use the onsite mining data and the Bitcoin price API data to calculate that profitability threshold or that LMP number.



Appx8020(60:9-17), Appx11. Storms believed this was “the real arbitrage opportunity,” Appx8021(62:13), Appx11, because “it would allow units of electricity to be sold at the most opportunistic price. ... [T]hey would mine [Bitcoin] in dollars versus being able to sell that back to the grid in dollars.” Appx8021(62:19-24); Appx11.

On April 19, 2019, Storms sent Hakes an annotated diagram titled “BearBox Automatic Miner Management System Version 1.0.” This diagram illustrated his BearBox System, in which a power entity (*e.g.*, wind farm) would have the option to either use power or sell power to the grid at the real-time LMP (“RT LMP Option”) based on the price of power. Appx12 ¶36.



Appx8949 (“RT LMP Option”).

On April 23, 2019, Storms told Hakes that he “got the model running.” Storms explained to Hakes that his model compared “real time LMP vs. network hashrate profitability in 5 min increments.” The 5-minute intervals correlated to the

frequency that the code would compare “mining versus what would be selling back power to the grid, if you were a generation asset owner.” Storms completed his Source Code by May 7, 2019. Appx12 ¶¶37, 39.

## **2. Lancium before meeting Storms**

Lancium was formed in November 2017 with the intention of building flexible datacenters, such as Bitcoin miners, at wind farms to take advantage of cheap electricity. Appx8115(436:12-14), Appx8116(437:11-438:16), Appx8141(533:4-5), Appx11767, Appx11784, Appx8143(541:21-542:15), Appx11606. Lancium sought to “ramp down” its datacenters to allow the wind farm to sell power to the grid when energy prices were high, but when prices were low, Lancium would “ramp up” its datacenters. Appx16 ¶51.

Lancium filed WO Patent Application No. 2019/139632 (“the ’632 Application”), titled “Method and System for Dynamic Power Delivery to a Flexible Datacenter Using Unutilized Energy Sources,” which names McNamara, Cline, and Henson as inventors with a priority date of January 2018. Appx16-17 ¶54.

The ’632 Application does not teach monitoring cryptocurrency pricing, network difficulty, or hashrates, nor does it teach performance strategies, breakeven calculations, or power consumption targets based on those monitored values. In fact, the ’632 Application does not use the words Bitcoin price,

hashrates, network difficulty, or breakeven. Lancium did not cite the '632 Application as prior art during prosecution of the '433 patent. Appx9711-9754.

The district court found that “Cline credibly testified” that “by the time the '632 Application was filed” Lancium monitored various conditions including “economic considerations,” such as the real-time price of power, the price of Bitcoin, and other information enabling Lancium to determine whether it was profitable to mine by calculating breakeven values (which Cline testified required monitoring network hashrate and network difficulty variables). Appx8124(472:9-14). In support of this finding, the district court cited only the '632 Application and Cline’s testimony. Appx17 ¶56. Despite the '632 Application’s limited disclosure, the district court further found that at Lancium’s Thomas Road facility Lancium was “monitoring some of the information disclosed in the '632 Application, including power and Bitcoin price, to determine a performance strategy based on whether it was profitable to mine Bitcoin.” In support of this finding, the district court cited only Cline’s trial testimony. Appx17-18 ¶57. The district court credited Cline’s testimony for other findings that were relied upon in the district court’s conclusions. Appx17-19 ¶¶56, 60, Appx29 ¶¶90, 91, Appx31 ¶97, Appx42 ¶125 (Cline testimony “credible”); Appx27-28 ¶¶85-86 (Cline testimony “credited”).

**3. The May 2019 meeting and document exchange and Lancium's subsequent pivot in its business strategy**

On May 3, 2019, Storms attended a Bitcoin conference in Boston to meet potential customers for his BearBox System. Appx20-21 ¶63. He met McNamara at a reception and then attended a dinner with about eight conference attendees including McNamara and Jon Cohen, Lancium's CFO. Appx21.

The dinner lasted about two hours. Storms sat across from and next to McNamara and Cohen, and they discussed the BearBox System, in which McNamara and Cohen showed interest. Appx21 ¶66. The district court, however, excluded Storms' testimony about what he told McNamara and Cohen as hearsay. Appx8025-8026(80:4-82:8).

McNamara admitted that Storms discussed his BearBox container, and that McNamara was interested. Appx21 ¶66. Despite not allowing Storms to testify about the subject matter of the dinner conversation, the district court relied on McNamara's testimony about that dinner, concluding that "based on these facts, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter claimed in the '433 patent to McNamara, or anyone else employed by Lancium, during the May 3, 2019 dinner." Appx21 ¶66.

McNamara and Storms exchanged phone numbers. On May 5, 2019, McNamara sent a text message to Storms stating: "I also think your boxes may

have some benefits vs the ones we are doing with JB [sic] driver[.] Lots of stuff to collaborate on.” Storms responded: “Absolutely, I can send you specs on the boxes/PDUs/logic design - what's your email?” McNamara then responded with his Lancium email address. Appx22 ¶69.

On May 8, 2019, McNamara sent another text to Storms, asking: “Storms, can you send me those box design specs please!” Appx23 ¶72. On May 9, 2019, Storms emailed McNamara (“Storms’ Email”). Appx9631. The subject line of Storms’ Email reads: “BearBox 20’ product details and supporting documents.” Attached to Storms’ Email were the following documents: (1) a one-page BearBox Product (“Spec Sheet”), Appx11371; (2) an annotated diagram of Bear Box's Automatic Miner Management System (“Diagram”), Appx11372; and (3) a data file modeling a simulation of the BearBox system (“Data File”), Appx11377-11393, Appx23-24 ¶¶73-74. McNamara then forwarded Storms’ Email to Cline, Chief Computing Officer at Lancium and named inventor on the ’433 Patent. Appx27 ¶84.

The BearBox Spec Sheet includes information related to BearBox’s physical and electrical components, software management, PDU/relay mapping, and optional real-time breakeven monitoring, and states that BearBox's containers could hold 272 Bitcoin miners, specifies different types of miners that could be

used, and that the maximum amount of power consumed was approximately 373kW.” Appx24 ¶75.

Storms’ Diagram illustrates a system wherein a BearBox container, e.g. a load, is connected to the electrical grid, depicted by a lightning bolt stemming from an illustration of six wind turbines, i.e. a power entity. The lightning bolt is connected to a pipe or conduit, which immediately has a T-coupling. Off one end of the T-coupling, the electricity generated from the wind turbines transmits to the BearBox container. From the other end of the T-coupling, i.e., horizontally, stems two dotted lines, one labeled “Hourly,” which is connected to a red bubble titled “Day-Ahead LMP for pricing node,” and the other labeled “5-minute,” which is connected to a red bubble titled “RTMB LMP for pricing node.”” Appx25 ¶78.

Storms’ Data File is a spreadsheet simulating operation of one possible configuration of the BearBox System. Appx24 ¶74. BearBox introduced evidence that the Data File showed that each of the BearBox System’s 272 miners consumed about 1.3kW, for a maximum demand of about 373kw, or about 31kWh per 5-minute interval (i.e. 373 kW per hour divided by twelve 5-minute intervals per hour). Appx8084(Tr. 309:14-310:15), Appx8085(313:21-22), Appx8085(316:10-15), Appx8086(319:5-18), Appx8086-8087(320:7-322:3); Appx8087(323:10-324:24), Appx8088(326:2-21).

BearBox introduced evidence that the Spec Sheet and Diagram show a system where a wind farm has an option, in 5-minute intervals, to sell electricity to the grid or use electricity to mine Bitcoin based on monitored conditions like Bitcoin price, hashrate, and network difficulty to calculate breakeven values. Appx8029-8030(94:23-100:13), Appx9633. The Spec Sheet also indicates that Storms' system included a software management layer for deciding whether to mine Bitcoin or sell power to the grid. Appx8029(94:7-22).

The district court found that Cline testified that he did not recall whether he opened Storms' Data File. The district also found that metadata showed that Cline did download Storms' Data File on May 9, 2019, the day Cline received it. Appx27 ¶85; Appx13577-13586. While during his deposition Cline testified that he did not recall opening Storms' Data File, at trial Cline said that after his deposition he "went back" and confirmed that he did download Storms' Data File *but not until April 2021* after receiving notice that BearBox sued Lancium. Appx8136(Tr. 518:4-19). Lancium did not produce an April 2021 version of Storms' Data File.

Cline also testified that he had previously been sued for breaching a non-disclosure agreement by allegedly using without permission verbal and presentation materials describing energy-related software. Appx8134-8135(512:5-513:4).

BearBox introduced evidence that in the weeks and months after meeting Storms Lancium began commercializing features for monitoring conditions related to Bitcoin mining profitability and real-time power prices and creating performance strategies based on those conditions for turning Bitcoin miners off during periods of high price and selling previously purchased power back to the grid. Lancium considered these to be “critical” discoveries Lancium had “previously missed,” resulting in “NEW” and “cool” features, the scope of which Lancium was still digesting, giving Lancium “a bigger opportunity [] than [Lancium] realize[d],” and for which there was “practically no limit.” Appx9234, Appx9274, Appx9310, Appx9318.

BearBox also introduced evidence of a document McNamara created after meeting Storms, which included the same data and calculations Storms sent by email in May 2019 regarding monitored Bitcoin price, hashrate, difficulty, breakeven values, real-time electricity pricing, and a comparison of profitability to elect the option of mining Bitcoin or not mining and selling the unused electricity. Appx8060(221:7-23), Appx9631-9635, Appx9310-9312, Appx8101(377:8-380:6). Lancium raised \$150 million from investors based in part on Lancium’s ’433 Patent and embodiments of those inventions Lancium commercialized. Appx9366-9411, Appx8155-8156(591:25-594:13), Appx9310, Appx9318.



## D. The district court proceedings

### 1. Discovery

Lancium admitted in discovery that it did not conceive the full combination, or many sub-combinations, of claim limitations until August 2019 to October 2019, after Storms communicated his ideas to Lancium in early May 2019. Appx8842-8878, Appx7150 ¶58.

BearBox produced claim charts mapping its contentions and supporting evidence, including the “power option agreement” as an agreement between the load and an “authorized entity” depicted in Storms’ Diagram as a wind farm, described in its interrogatory responses as “an underutilized wind farm,” and a “minimum power threshold” as the minimum amount of power used by the system in 5-minute increments:

’433 Patent, Claim 1	BearBox Second Supplemental Response to Interrogatory No. 3
receive power option data based, at least in part, on a <b>power option agreement</b> , wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, wherein each <b>minimum power threshold</b> in the set of minimum power thresholds is associated with a time interval in the set of time intervals;	Austin Storms conceived of and developed technology that includes receiving power option data based, at least in part, on a power option agreement ... For example, Mr. Storms’ system used multiple time intervals, including the day-ahead hourly intervals and real-time 5-minute intervals, each of which included an associated minimum power threshold used in periodically determining performance strategies (i.e. every five minutes) and <b>negotiating power</b>

	<p><b>purchasing arrangements with authorized entities (such as a fixed-duration power option agreement or the like).</b> See, e.g., BB0000001-18, 21-28, 35-38, 45, 62 and 73-81 ... BB00000019-20, 29-34, 40-44, 46-61 and 63-72</p> <p>***</p> <p>Mr. Storms developed software that used multiple time intervals, including the day-ahead hourly intervals and real-time 5-minute intervals, <b>each of which included an associated minimum power threshold used in periodically determining performance strategies (i.e. every five minutes)</b> and negotiating power purchasing arrangements with authorized entities (such as a fixed-duration power option agreement or the like). Id.; see, e.g., BB_SC00000043 (<b>showing multiple power thresholds associated with miners performing at different capacities</b>). As reflected in the metadata of the source code, Mr. Storms developed this software no later than April 29, 2019.</p>
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Appx6817-6818.

BearBox also responded to Lancium's Interrogatory No. 21 that BearBox understood a power option agreement to include an agreement between a power entity and a load, and otherwise agreed with Lancium's use of the term when enforcing the '433 patent against a competitor called Layer1 a few months earlier:

[BearBox's] understanding is that a power option agreement, as that term was used in Plaintiffs' supplemental response to Interrogatory No. 2, is consistent with the use of that term as claimed and described in the '433 Patent, and includes an agreement between an entity associated with the delivery of power to a load and the load, and is consistent with how the Defendants used the term "power option agreement" in documents in Case No. 6:20-cv-00739, for example in the Complaint, LANCIUM00016546, and Exhibit H, LANCIUM00016631.

In the Layer1 case, Lancium said that a "power option agreement" is commercially known as a "demand response contract." Appx9003-9028. During expert discovery, BearBox's ERCOT expert, Frank McCamant, testified that demand response contracts have been known and used for over 20 years. Appx8054(194:1-3), Appx8 n.4. Lancium did not object to these BearBox discovery responses.

Storms also described that when the option to turn off was exercised the entity holding the option, such as the wind farm, would be free to liquidate (i.e. sell back) the unused power onto the grid. Storms testified that he conceived of the option residing with various entities, including the load, the generator (e.g. wind farm), or other market participants:

Q. In the context you're talking about, who sells the power back to the grid?

A. Variety of different options there. It could be the generator sells the power back. It could be the mining

facility sells the power back. It could be a different market participant depending on the ISO.

Appx2810(105:5-10).

Storms also confirmed during his deposition that he envisioned his system as maintaining a “minimum power threshold.” Appx2899-2900(171:12-19).

## **2. Expert discovery**

BearBox’s technical expert, Dr. Stan McClellan, is a full-tenured professor of Electrical and Computer Engineering at Texas State University. Lancium did not challenge McClellan’s qualifications and the district court recognized him as an expert in electrical and computer engineering and smart grid technologies. Appx8075(275:13-16).

McClellan’s opening expert report concluded that Storms conceived, reduced to practice, and communicated to Lancium the inventions claimed in the ’433 patent. McClellan’s analysis “applied the plain and ordinary meaning of the claim terms,” but McClellan “reserve[d] the right to supplement [his] report should Lancium use a different construction, if the Court provides a construction, or the like.” Appx2734 ¶49.

McClellan’s opinion was that the invention “enable[d] *a computing system* to adjust power consumption based on a power option agreement.” Appx2733 ¶44 (emphasis added). McClellan’s opinion did not depend on whether the control system belonged to a load, power entity, or another entity. McClellan opined that

Storms' design evidenced the concept, generally, that the Bitcoin miners could be controlled by anyone from any "remote" location. Appx2856 ¶77 ("In my experience writing code and simulations, a system designer will typically make many assumptions about real-world variables in order to test other aspects of the system ... replacing Mr. Storms' assumed power availability with data from an ISO or QSE was a well-known, conventional capability that would have required merely ordinary skill to implement.").

McClellan opined that Storms' concept, and simulation, included a "master control system positioned remotely" from the Bitcoin miners it was designed to turn on and off. Appx2754 ¶108. McClellan analyzed Storms' source code files and their functions, concluding that the simulation "remotely communicate[s]" with miners, and that the protocols in the simulation had been used for decades to control functions through a master control system "physically remote from the resources under their control." Appx2755.

McClellan described the "option" or "the ability" to turn off the miners in the passive voice, focused on Storms' designs' capability of being controlled by any entity from a physically remote location. Appx2739 ¶62 ("The Bearbox system also included custom PDU software capable of providing fine grain load control (i.e. *the ability to turn on some but not all of the miners*) and also was configured

to work modularly with a variety of different miners that had different power requirements.”).

Because McClellan’s opinion was that Storms conceived of a system in which *any* entity could hold the option in a power option agreement, he necessarily held the opinion that a power entity could hold the option in a power option agreement and cited to Storms’ deposition testimony discussing exactly that type of configuration. Appx2748-2749 ¶90 (citing Storms).

McClellan opined that Storms conceived of a power entity-held option at least because Storms had built his system to work with a wind farm that would have been required to enter power option agreements through a QSE. McClellan further spoke with McCamant and McCamant’s report clarified that the only way for a wind farm to enter into any contract, including a power option agreement, was to work through a QSE. Appx2681 (“The QSE is the only entity that interacts with ERCOT on behalf of [a wind farm]”).

McClellan answered deposition questions about his opinions that various entities (including a power entity) could hold the option. For example, McClellan said that the BearBox System would work when a grid operator (“power entity”) or local substations hold the option to reduce power consumption (turn the Bitcoin miners off). Appx6115(18:5-12).

McClellan also explained that the BearBox System could be curtailed by a generator (*e.g.*, wind farm). Appx6151(165:23) (“A generator could use it as a local load.”). McClellan’s opinion was that Storms’ BearBox System was capable of control from any vantage point.

Q. But my question for you is Mr. Storms’ system, is it designed to be implemented at the load side or at the generator side?

A. I don't -- I don't think it matters. I think it just consumes some amount of electricity and optimizes the cost, optimizes the profit versus the cost. It doesn't matter where in the system it's actually implemented separately from ERCOT.

Appx6151(164:11-18).

He concluded: “It can work anywhere.” Appx6164(217:10-17).

During his deposition, McClellan briefly confused terminology and described a power purchase agreement (a term of art in the utilities industry) instead of the claimed “power option agreement,” but admitted his mistake. Appx6132(86:24-87:1) (“I tend to use them interchangeably, and that may not be exactly right.”). McClellan at other times during his deposition expressed concern regarding the use of “consume” and “use” when testifying about the minimum power threshold, cautioning “we’re using overloaded terms like consume.” Appx6153(170:1). In the end, McClellan explained that any confusion over these terms during his deposition was due to a misunderstanding about whether he was

being asked about commercial agreements embodying the invention (which he admitted he did not fully understand), and the claimed invention. McClellan tried to end the confusion, declaring “there’s a contract, and then there's this language in the patent, and I’m trying to draw the distinction between the two. The contract language may not make you use the power.” Appx6148-6149(153-156).

Lancium’s expert, Dr. Mark Ehsani, served a responsive report disagreeing with McClellan’s conclusions but also applying the plain and ordinary meaning of the claim terms. Ehsani’s report says the ’433 patent specification describes a “power option agreement,” and Ehsani pasted portions of the specification into his report. Dr. Ehsani’s report also suggests that the option in a power option agreement may be controlled by the load (not the power entity). Appx5850 ¶108 (“The remote master control system can serve as a control system to the load.”).

Ehsani never provided a supplement, despite saying he would if “any of Plaintiffs’ experts use a different construction, or provide their understanding of the plain and ordinary meaning that is different than my understanding.” Appx5846.

**3. The district court construed two claim terms following the close of expert discovery after Lancium had previously said that claim construction was not needed**

Lancium proposed a non-patent scheduling order because it believed claim construction was not necessary. Appx4843-4856. Lancium later agreed that “by



August 27, 2021, the parties shall determine whether or not claim construction is necessary and further notify the Court of their decision.” Appx1435 ¶8. The Court, at BearBox’s request and over Lancium’s objection, extended that deadline such that the claim construction phase of the case ended on October 15, 2021.

Appx1501 (“[Lancium does] not believe claim construction will be needed, and [Lancium] oppose[s] [BearBox’s] attempt to extend the deadline”). On October 15, 2021, Lancium again told the Court it “do[es] not request claim construction at this time.” Appx1537.

After the close of all discovery, on June 15, 2022, Lancium moved for summary judgment and for the first time raised a claim construction dispute for “power option agreement” and “minimum power threshold,” arguing that “it was only during the deposition of Plaintiffs’ expert ... that Defendants learned Plaintiffs’ proposed plain and ordinary” meanings. Appx2611-2656, Appx5916. Lancium argued that the “proper construction” of those terms was dispositive of BearBox’s inventorship claims on summary judgment. Appx2626; Appx7484(40:14-15) (“if [Defendants’] constructions are adopted, we think it is dispositive on summary judgment”). BearBox disagreed. Appx4265, Appx4271-4273.

On September 28, 2022, Lancium asked the district court for oral argument on summary judgment noting that “the Court has not previously conducted claim

construction.” Appx5952-5953. BearBox argued that Lancium’s purported claim construction dispute was untimely, at least because Lancium had repeatedly assured BearBox and the district court, throughout the claim construction phase of the case, which ended eight months earlier, that claim construction was unnecessary. Appx5954, Appx1476.

Nevertheless, the district court held a *Markman* hearing on October 20, 2022 and on October 28, 2022, the Court issued its *Markman* ruling, adopting Lancium’s proposals (including a compromised portion and BearBox’s clarifications) for “power option agreement” and “minimum power threshold.” Appx6005-6020. On November 14, 2022, the Court applied its construction of “power option agreement” and “minimum power thresholds,” and denied Lancium’s motion for summary judgment, relying in part on McClellan’s report. Appx90-91 (“Dr. McClellan, maps each limitation claimed in the ’433 Patent to the systems and methods allegedly conceived by Storms.”). Appx70 (“the present record is replete with testimony and documents that could support a factfinder’s reasonable inference that Austin Storms conceived of the ’433 patent’s subject matter, as properly construed by this Court, prior to Lancium’s purported conception.”).

Following denial of summary judgment, during a pretrial meet and confer on November 3, 2022, Lancium argued that McClellan cannot consider the Court’s *Markman* order as part of his trial testimony because McClellan’s reports were

served prior to, and his opinions were inconsistent with, the *Markman* order. Appx6974-6975. BearBox disagreed with both arguments and in support of its positions, on November 11, 2022, BearBox served a supplement to McClellan's reports to "reiterate[] and clarif[y] some of [his] earlier analysis ... in consideration of the Markman Order," and offered "a schedule for [Lancium's] expert to respond to the supplement." Appx6095-6108.

Lancium instead moved to strike McClellan's supplement, stating that BearBox's justification, "to apply the language of the Court's claim construction," was meritless. Appx6089-6191. BearBox argued that McClellan not only had a right but an obligation to consider the *Markman* order, that his supplemental report clarifies his existing opinions but with the benefit of the Court's claim construction, and that Lancium's delay in raising a claim construction dispute was the origin of any unfortunate timing. Appx6744-6940. On November 23, 2022, the Court granted Lancium's motion to strike stating "it is clear that Dr. McClellan is offering new legal theories and opinions." Appx92-97.

Specifically, the district found that McClellan's supplement offered analysis of how Storms conceived of a system where the power entity held the option, but "McClellan was previously of the opinion that the load, not the power entity, held the option." Appx93. The district court also found that McClellan offered a "new opinion" that "now applies 'consume' and 'use' interchangeably—although he

previously opined that a load was not required to use the ‘minimum power threshold.’” Appx94. The district court cited only portions of McClellan’s deposition transcript (not his reports) in distinguishing “previous” opinions and “new” opinions.

The district court further held, without citation, that “neither Dr. McClellan’s Opening Report nor his Reply Report explain how BearBox’s system operated by maintaining “a minimum power threshold.” Appx94. The district court also found that McClellan’s supplement was “untimely” and “indicates bad faith.” Appx94-95. Further, the district court found that BearBox’s excuse that the supplement was the result of Lancium’s untimely pursuit of claim construction “is meritless” because Lancium’s interpretation of the claim terms “was evident” upon disclosure of Lancium’s expert’s report and McClellan “had an obligation” to address it. Appx96.

**4. The district court granted summary judgment of no conversion based on preemption**

The district court initially dismissed BearBox’s conversion claim finding that it was preempted by federal patent law because it would require “a determination of inventorship,” but the court allowed BearBox an opportunity to amend to plead a claim that would not be preempted. Appx1615-1623, Appx1630. In response to that ruling, BearBox filed its Second Amended Complaint (“SAC”) alleging a conversion count that did not depend on a determination of patent

inventorship. Appx1649-1650. Lancium again moved to dismiss the conversion claim, but not on the basis of preemption, Appx2024-2041, and the Court denied that motion with respect to conversion, Appx5957-5965. Later, however, in response to a summary judgment motion, the district court dismissed BearBox's conversion claim as preempted. Appx84-89.

## **5. Pre-Trial and Trial**

At the pretrial conference, Appx13858-13876, the district court granted-in-part and denied-in-part Lancium's motion in-limine seeking to preclude McClellan's testimony, stating that McClellan may testify, just not "inconsistently with the Court's Markman opinion," Appx13871(14:6-12). The district court further denied as moot the motion because the district court had stricken McClellan's supplement. Appx13871(14:13-15).

At trial, Lancium repeated its position that McClellan cannot testify at all because McClellan's previous opinions were "contrary to Your Honor's construction[s]," so "any testimony Dr. McClellan offers ... were either stricken by Your Honor's ruling or are inconsistent with Your Honor's claim construction." Appx8007(7:25-8:5).

BearBox argued that Lancium continued to take "sound bites out of the deposition" and "make that representative of Dr. McClellan's opinions as a whole." Appx8007(9:1-4). The district court reiterated, "So we're clear that his

supplemental report was stricken,” and “McClellan can’t come to trial now and give new opinions that aren’t supported by his original report.” Appx8069(254:18-20).

During his testimony, the court allowed McClellan to present a demonstrative slide with the court’s claim construction but did not allow McClellan to substantively testify about any opinions applying the evidence to those constructions. Appx8090(333:20-334:5).

### **SUMMARY OF THE ARGUMENT**

The district court erred in dismissing BearBox’s conversion claim as preempted by federal patent law because BearBox’s conversion claim is not based on conduct that is protected by federal patent law. BearBox’s conversion claim instead seeks damages for conversion of documents and information and is independent of any patent inventorship determination. By dismissing conversion, the district court denied BearBox its right to a jury trial. Because its conversion and inventorship claims are based on overlapping factual issues, BearBox was entitled to a jury trial on all claims.

The district court abused its discretion when it struck McClellan’s supplemental expert report served in response to the Court’s claim construction ruling entered after the close of expert discovery. BearBox was not on notice that Lancium would seek construction of any claim terms until Lancium filed its

summary judgment motion (and accompanying request for claim construction) *after* the close of expert discovery and after previously telling the district court that claim construction was not needed. Under these circumstances, BearBox's expert was entitled to serve a supplemental expert report to take into account the Court's claim construction. The district court abused its discretion because McClellan's supplemental report did not offer entirely new opinions, and even if it did, the extreme sanction of striking it prejudiced BearBox's trial presentation and resulted in exclusion of critical trial evidence by constraining McClellan's testimony.

The district court further erred in holding BearBox to standards of conception that have been repeatedly rejected. The test for conception requires evaluating an inventor's story and then testing the veracity of that story with corroborating evidence under the Rule of Reason, which requires consideration of all pertinent evidence together as a whole, and through the lens of the claim elements in combination. The district court failed to do so because it failed to consider Storms' testimony and wrongly excluded critical testimony as hearsay. The district court also analyzed individual claim elements (rather than combinations) and compared them to corroborating documents one at a time rather than collectively and ignored other corroborating evidence altogether.

The district court also erred by focusing on whether Storms' simulation of his invention actually performed the claimed functions rather than considering

whether the simulation corroborated that Storms possessed the claimed concepts. In contrast, when finding that Lancium independently conceived of certain claim elements prior to Storms' communication, the district court required no corroboration, relying only on the purportedly credible testimony of Cline and, due to its flawed element-by-element, document-by-document analysis, the district court ultimately credited Lancium with conception dates that were earlier than even Lancium believed it was entitled to.

## **ARGUMENT**

### **I. Standards of Review**

“This court reviews a district court’s grant of summary judgment under the law of the regional circuit, here the Third Circuit.” *Acceleration Bay LLC v. 2K Sports, Inc.*, 15 F.4th 1069, 1075 (Fed. Cir. 2021). “The Third Circuit reviews a district court’s grant of summary judgment de novo.” *Id.*

This court reviews a decision to strike an expert report under the law of the applicable regional circuit. *Treehouse Avatar LLC v. Valve Corp.*, 54 F.4th 709, 713 (Fed. Cir. 2022). The Third Circuit reviews such a decision for an abuse of discretion, considering a list of five *Pennypack* factors. *Astellas US LLC v. Hospira, Inc.*, 2022 WL 17998229, at \*5 (Fed. Cir. 2022) (applying factors in appeal from the District of Delaware); *Meyers v. Pennypack Woods Home Ownership Ass’n*, 559 F.2d 894, 904-05 (3d Cir. 1977).



This Court reviews a district court’s overall inventorship determination de novo, and reviews underlying findings of fact for clear error. *Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1358 (Fed. Cir. 2023). A court’s conclusions about corroboration under the “rule of reason” analysis is factfinding. *Id.* at 1357.

## **II. The district court erred in granting summary judgment dismissing BearBox’s state-law conversion claim**

### **A. Federal patent law does not preempt BearBox’s conversion claim**

In its Second Amended Complaint, Appx1631-1654, BearBox pled a conversion claim that does not depend on a determination of patent inventorship, but instead sought compensation for Lancium’s wrongful taking of BearBox property, Appx1649-1650. When denying Lancium’s motion to dismiss, the district court recognized that conversion under Louisiana law “is a broadly defined tort” that provides a remedy for acts “in derogation” of an owner’s rights, which can “include wrongfully interfering with an owner’s electronic documents, regardless of whether the owner has retained copies of the documents.” Appx5961-5962. The district court, however, later granted summary judgment dismissing BearBox’s conversion claim on the basis of “conflict” preemption. Appx84-89.

The district court erred because conflict preemption only preempts a state-law cause of action where it is based on “conduct that is protected or governed by federal patent law.” *Hunter Douglas, Inc. v. Harmonic Design, Inc.*, 153 F.3d

1318, 1335 (Fed. Cir. 1998), *reversed on other grounds*, *Midwest Indus., Inc. v. Karavan Trailers, Inc.*, 175 F.3d 1356, 1359 (Fed. Cir. 1999).

Here, BearBox’s state-law claim is not based on acts of patent infringement but is based on acts of converting documents and information. Preemption does not apply where a state-law cause of action “springs not from an attempt to enforce intellectual property rights, but instead from [the defendant’s] alleged wrongful use” of the plaintiff’s documents and information. *Univ. of Colorado Found., Inc. v. Am. Cyanamid Co.*, 196 F.3d 1366, 1372 (Fed. Cir. 1999). In *University of Colorado*, this Court reversed where a district court applied a state common law standard for inventorship, rather than relying on federal law to determine inventorship. *Id.* at 1372 (“[F]ederal patent law preempts any state law that purports to define rights based on inventorship.”). But this Court found that the underlying state *causes of action* were *not* preempted. Instead, a state-law cause of action is *not* preempted, even if it would require application of federal patent law. *Id.* at 1371-74. And this Court specifically found that a claim of unjust enrichment, premised on “wrongful use” of information, like BearBox’s claim here, is not preempted. *Id.* at 1371-72.

BearBox’s conversion claim would not require application of federal patent law. A claim of conversion under Louisiana law requires proof of the following elements: (1) plaintiff’s “right to possess”; (2) “the defendant’s use was

inconsistent with the plaintiff’s right of ownership”; and (3) “the defendant’s use constituted a wrongful taking.” *Mabile v. BP, p.l.c.*, 2016 WL 5231839, at \*21 (E.D. La. Sept. 22, 2016). The tort includes taking property and asserting ownership over it. *Id.* The tort of conversion is accordingly directed to ownership of property, not inventorship. It requires proof of ownership and conduct inconsistent with that ownership. In contrast, BearBox’s inventorship claim requires a showing that Storms is an inventor of the inventions claimed in the ’433 patent, which does not require proof that the defendants wrongfully took Storms’ property and misused it.

Where the “ideas and materials” alleged to support a state-law cause of action “are not found” in a patent, “nothing in federal patent law ... stands in the way” of the state-law claims. *Wawrzynski v. H.J. Heinz Co.*, 728 F.3d 1374, 1381 (Fed. Cir. 2013). Here, BearBox does not seek to enforce patent rights through its conversion claim. The claim instead provides a remedy to BearBox that is not “patent like.” The district court erred in granting summary judgment dismissing BearBox’s conversion claim.

**B. BearBox was entitled to a jury trial on both its conversion and inventorship claims because the factual issues to be decided are substantially common among them**

After granting summary judgment dismissing BearBox’s conversion claim, the district court ordered that the previously scheduled jury trial would be a bench

trial. Appx6074. Lancium had moved to bifurcate the trial, Appx6024-6043, which BearBox opposed, Appx6062-6073. The district court never decided the bifurcation motion because it dismissed BearBox's conversion claim.

BearBox was entitled to a jury trial on both its conversion and inventorship claims. In deciding whether to try a case to a jury, a district court's "discretion is very narrowly limited and must, wherever possible, be exercised to preserve jury trial." *Beacon Theatres, Inc. v. Westover*, 359 U.S. 500, 510 (1959); *see also Dairy Queen, Inc. v. Wood*, 369 U.S. 469, 479 (1962). Where an equitable claim presents issues that "are common with those upon which [a] claim to equitable relief is based, the legal claims involved in the action must be determined prior to any final court determination of [the] equitable claims." *Dairy Queen*, 369 U.S. at 479.

While BearBox's conversion claim does not require a determination of patent inventorship, there are nevertheless common factual issues between the conversion and inventorship claims. By deciding the issue of inventorship, the district court deprived BearBox of its right to a jury trial on common factual issues such as the factual question of whether BearBox communicated anything of value to Lancium, an issue that a single fact-finder (a jury) must decide. *See Shum v. Intel Corp.*, 499 F.3d 1272, 1279 (Fed. Cir. 2007) (reversing district court's decision to try inventorship to the bench before a separate jury trial on a fraud

claim due to “commonality . . . between the factual issues underlying the inventorship and fraud claims”).

A jury should further decide the common issue of whether Storms communicated anything of value to Lancium or whether he merely communicated documents reflecting prior art methods. All of this information was communicated to Lancium as part of the same oral and written communications, and a jury should decide the scope and content of the communications and the extent to which Lancium employees reviewed and used the information. These findings would rely on the same documents and testimony about Lancium’s pursuit of the patent-in-suit and its commercialization and unauthorized use of the converted property. The common issue of whether Storms contributed anything of value to Lancium presents intertwined factual issues that a jury should have resolved for all claims.

### **III. The district court abused its discretion in striking McClellan’s supplemental report**

Striking expert testimony otherwise admissible is an extreme sanction reserved for the most egregious of circumstances. BearBox has not found, nor has Lancium cited, a single case in which a district court struck a supplemental report applying a claim construction ruling resolving a dispute raised by the movant for the first time after the close of expert discovery. Doing so here was contrary to Federal Circuit and Third Circuit law.

Lancium cited *O2 Micro* in convincing the district court it “must” resolve the dispute. Appx3450. Lancium also cited *Level Sleep*, which discusses rolling claim construction, or clarifying or supplementing an existing construction. In both cases, claim construction was initially raised at the claim construction phase of the case and modified later. Neither *O2 Micro* nor *Level Sleep* endorse raising disputes for the first time months after the claim construction phase of a case has ended. *Level Sleep LLC v. Sleep No. Corp.*, No. 2020-1718, 2021 WL 2934816, at \*3 (Fed. Cir. July 13, 2021); *O2 Micro Int’l Ltd. v. Monolithic Power Sys., Inc.*, 467 F.3d 1355, 1364 (Fed. Cir. 2006).

By failing to raise disputes during the claim construction phase of the case, Lancium waived its right to do so. *Cent. Admixture Pharmacy Servs., Inc. v. Advanced Cardiac Sols., P.C.*, 482 F.3d 1347, 1356 (Fed. Cir. 2007) (“The district court found that ACS waived any argument with respect to this term by failing to raise it during the claim construction phase. We agree.”)

Though Lancium argued that claim construction was only necessary after first learning of McClellan’s interpretation of the terms at issue during his deposition, Lancium also said “we didn’t know until we took [] McClellan’s deposition sort of where they were thinking about going with what they understood the plain and ordinary meaning to be.” Appx13821(18:5-8). Lancium, however, had been aware of BearBox’s interpretation of these claim terms at least since

BearBox’s discovery responses mapping evidence to each limitation of the claims, and BearBox’s responses to Lancium’s interrogatories. However, even if Lancium is to be believed that it did not know “what [BearBox] understood,” Lancium should have raised disputes at the appropriate time.

**A. The district court erred in concluding that McClellan’s supplement offered new opinions**

Supplements to expert reports are permitted if they do not offer new opinions, only “elaborations,” “clarifications,” and “further detail” on existing opinions. *Vectura Ltd. v. GlaxoSmithKline, LLC*, No. 16-638-RGA, 2019 WL 1436296, at \*2 (D. Del. Apr. 1, 2019). This is particularly true when experts first “offer their opinions before the court issue[s] its claim construction.” *Golden Bridge Tech., Inc. v. Apple Inc.*, No. 10-428-SLR, 2013 WL 1431652, at \*3 (D. Del. Apr. 9, 2013).

In its opinion striking McClellan’s supplement, the district court erred in concluding that McClellan “previously opined that load was not required to use the ‘minimum power threshold’” Appx6131(84:18-85:1) and that “neither [his] Opening Report nor his Reply report ... explain how BearBox’s system operated by maintaining ‘a minimum amount of power a load must use during an associated time interval.’” These mistakes were foundational to the district court’s reasoning in striking McClellan’s supplement.

Contrary to the district court's holding, McClellan had previously opined that the load *was* required to use the minimum power threshold. In his reports, McClellan said that Storms' code simulated the minimum amount of power (e.g. "kw\_load") as the power "utilized" for mining Bitcoin for a specified interval (e.g. five minutes), until the real-time price of electricity updates (e.g. every five minutes) and a new strategy is computed. McClellan described this required kw\_load usage (kilowatts used by the load) as maintained or required by a "hold" function, referring to a source code file "arb\_main\_AEC.py." Appx2741-2742 ¶¶66-67, Appx2748-2750 ¶¶90-91, Appx2750-2751 ¶¶95-96, Appx2761-2762 ¶¶130-132, Appx2774 ¶¶172.

McClellan also said this element is present in Storms' Data File, e.g. columns "real\_time\_LMP" and "real\_time\_LMP\_rev," showing the money to expect "from *using* power to mine Bitcoin" over a five-minute interval shown in column "datetime." Appx2777 ¶178 (emphasis added). McClellan also opined that this is present in the Diagram and Spec Sheet, which shows 5-minute real-time price updates, and various minimum load values, e.g. "Dragonmint T1, S9j," with a max load of "373 kW," and "PDU/relay mapping" showing "the ability to turn on some but not all of the miners." Appx2840-2841. McClellan reiterated this opinion three times during his deposition.

Q. What -- is there any specific data that's required to be power option data, or can it be anything?



A. I think at least it has intervals and minimum thresholds. There may be other data that's associated with that, but I think there's thresholds over intervals.

Q. And intervals are intervals of time?

A. Time intervals, yeah.

Q. And what are thresholds?

A. You agree to buy power at that -- you agree to consume that much power at a certain price at that time.

Appx6131(83:14-23), Appx6131(84:18-20), Appx6149(154:21-155:12).

McClellan's supplement did little more than quote his and Storms' depositions, his original reports, and explain why his previous opinions are consistent with the *Markman* order, which did not yet exist when he served his original reports. Appx6095-6108. McClellan's supplement relied on no evidence that was not already present in his original reports. BearBox believed McClellan's supplement was appropriate under the circumstances. *Air Turbine Tech., Inc. v. Atlas Copco AB*, 410 F.3d 701, 713 (Fed. Cir. 2005) (parties should "at least attempt[] to supplement [the expert's] report" after claim construction rulings).

The district court erred in its finding because it collapsed the entirety of McClellan's opinions, including his reports and deposition testimony, into a confused deposition quote in which McClellan thought he was being asked about commercial implementations of the claimed invention (e.g. what is "contracted"), not the claim language.

Q. What specifically is a minimum power threshold?

A. That's the amount of power that you're contracted to consume.

Q. And by consume you don't mean use, correct?

A. I may not use it, but I'm going to consume it. I'm purchasing it. Whether I use it or whether I sell it, that's a completely separate issue. I'm agreeing to purchase it at that threshold.

Appx6131(84:18-20).

McClellan tried to clarify this confusion later in his deposition.

Appx6149(154:1-4)(“There's the patent language and there's the business of making the contract with the service provider, and I think those two things are separated somehow.”). After some additional confusion, McClellan tried again.

I'm saying in the power option agreement, I believe I said it's not clear to me whether the power option agreement mandates that you use the power. That's a question for McCamant. I believe I said that several times. I don't know about the contract – there's a contract, and then there's this language in the patent, and I'm trying to draw the distinction between the two. The contract language may not make you use the power.

Appx6149(155:19-156:2). The district court, however, did not reconcile or even acknowledge these portions of McClellan's testimony or McClellan's original reports.

Even if Lancium's and the district court's perceived inconsistencies in McClellan's testimony were actual inconsistencies, striking the supplement was an

abuse of discretion. Cross-examination, contrary evidence, and instruction on the burden of proof “are the traditional and appropriate means of attacking shaky but admissible evidence.” *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 596 (1993); see also *Advanced Fiber Techs. Tr. v. J & L Fiber Servs., Inc.*, No. 107-CV-1191 LEK/DRH, 2010 WL 1930569, at \*6 (N.D.N.Y. May 11, 2010) (“purported inconsistencies” between an expert’s “report and later deposition testimony” is not the basis of exclusion, rather “should be addressed through cross-examination”).

This abuse of discretion was not harmless. In striking the supplement, and because of the district court’s flawed findings in support, McClellan was unable to offer the full breadth of his original opinions at trial, unable to testify on the construed terms, and was therefore unable to apply BearBox’s conception evidence to the full combination of claim elements. Moreover, the district court’s flawed analysis of what was “previous” and “new” bled through to many aspects of its final decision. Appx33 (“the Court finds that Dr. McClellan’s testimony ... was not credible based on multiple inconsistencies between Dr. McClellan’s expert reports, deposition testimony, and trial testimony.”)

**B. Even if it offered new opinions, the district court erred in its application of the *Pennypack* factors**

Assuming, *arguendo*, that McClellan’s supplement did offer new opinions it was still an abuse of discretion to strike it, which is an “extreme sanction,” not

normally warranted absent a showing of willful deception or flagrant disregard of court orders. *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 792 (3d Cir. 1994). BearBox served McClellan's supplement on November 11, 2022, two weeks after the *Markman* order, and eight days after the parties met and conferred on Lancium's motion in limine to preclude McClellan from testifying inconsistently with the *Markman* order which, in Lancium's view, meant precluding the entirety of McClellan's testimony. Appx6095-6184.

The district court found the supplement was in "disregard of the express terms of the Court's Scheduling Order" which "indicates bad faith which weighs in favor of exclusion." Appx95. That same Scheduling Order set closed the claim construction phase of the case on October 15, 2021. Appx1431-1440, Appx1501. Lancium did not raise a claim construction dispute until its motion for summary judgment on June 15, 2022 despite being on notice of BearBox's interpretation of the plain meaning of those terms throughout the case. BearBox's supplemental expert report disregarded the scheduling order no more than Lancium's late identification of a claim construction dispute. *Dow Chem. Co. v. Nova Chemicals Corp. (Canada)*, No. CIV.A. 05-737-JJF, 2010 WL 2044931 (D. Del. May 20, 2010) (declining to strike a supplement based on an issue the movant "introduced to the litigation after the deadline to file expert reports").

In support of its decision, the district court cited *Praxair*, *Masimo*, and *St. Clair*, none of which struck a supplement that followed a claim construction order resolving a dispute raised for the first time after the close of expert discovery. In *Praxair*, the stricken supplement was served one month after expert discovery had closed but three months after a joint claim construction statement “identifying for the Court the limitations ... that require construction, including each party’s proposed construction.” *Praxair, Inc. v. ATMI, Inc.*, 231 F.R.D. 457, 463-64 (D. Del. 2005), reversed on other grounds by *Praxair, Inc. v. ATMI, Inc.*, 543 F.3d 1306 (Fed. Cir. 2008). In *Massimo*, the stricken supplement contemplated a non-infringing alternative that was undisputedly disclosed before opening expert reports. *Masimo Corp. v. Philips Elec. N. Am. Corp.*, 62 F. Supp. 3d 368, 389 (D. Del. 2014). Finally, in *St. Clair* the stricken supplement was served months after the parties had fully briefed all claim construction disputes. *St. Clair Intell. Prop. Consultants, Inc. v. Matsushita Elec. Indus. Co.*, 2012 WL 1015993, at \*8 (D. Del. Mar. 26, 2012), aff’d, 522 F. App’x 915 (Fed. Cir. 2013).

Unlike *Praxair*, *Masimo*, and *St. Clair*, BearBox was not on notice of a dispute regarding the plain meaning of these terms. If anything, BearBox was repeatedly assured that there was no dispute. Lancium did not complain about BearBox’s contentions, nor did Lancium object to BearBox’s interrogatory response detailing its understanding of the meaning of a “power option

agreement.” Lancium resisted claim construction from the outset of the case and on multiple occasions explicitly told the district court that there were no disputes and even opposed BearBox’s attempt to extend the deadline to identify disputes.

Appx1501 (“Defendants do not believe claim construction will be needed, and Defendants oppose Plaintiffs’ attempt to extend the deadline in Paragraph 8 of the Scheduling Order until October 15, 2021.”). Lancium’s expert, Ehsani, promised he would supplement his report if he thought there was a claim construction dispute. He never supplemented.

Despite this, the district court held that McClellan “had an obligation to address Lancium’s ... plain and ordinary meaning of these *disputed terms*.” Appx5954 (emphasis added). But there were no disputed terms until *after* the close of expert discovery.

The district court further erred in its weighing of the *Pennypack* factors, which include: (1) the prejudice or surprise to the party against whom the evidence is offered; (2) the possibility of curing the prejudice; (3) the potential disruption of an orderly and efficient trial; (4) the presence of bad faith or willfulness in failing to disclose the evidence; and (5) the importance of the information withheld.

*Meyers v. Pennypack Woods Home Ownership Ass’n*, 559 F.2d 894, 904-05 (3d Cir. 1977).

As an initial matter, the district court erred by failing to even consider “the most important [*Pennypack*] factor,” the importance of the evidence to be excluded. *ZF Meritor, LLC v. Eaton Corp.*, 696 F.3d 254, 299 (3d Cir. 2012). Expert testimony in patent cases is critical evidence, as it was here. McClellan mapped Storms’ conception evidence to the ’433 patent claims and was the only witness offered to address Lancium’s defenses and rebut Lancium’s technical expert. Striking McClellan’s supplement, and the subsequent related holdings up to and during trial, significantly narrowed McClellan’s trial testimony. *Id.* at 117 (finding an abuse of discretion in the district court’s exclusion of expert testimony, in part, because the exclusion of such testimony “was tantamount to a dismissal of the [plaintiff’s] ... claim.”). This failure alone supports a finding of abuse of discretion. *Coal. to Save Our Child. v. State Bd. of Educ. of State of Del.*, 90 F.3d 752, 790 (3d Cir. 1996) (vacating decision because there was “no evidence in the record that the district court considered the importance of [the] proffered testimony”).

Further, the district court erred in weighing the second and third *Pennypack* factors in favor of striking McClellan’s supplement. Lancium could not be prejudiced by its own strategic choice to raise claim construction at the summary judgment phase, eight months after the claim construction phase of the case. *Dow*

*Chem. Co. v. Nova Chemicals Corp. (Canada)*, No. CIV.A. 05-737-JJF, 2010 WL 2044931 (D. Del. May 20, 2010).

Finally, even if the district court was correct in its conclusion that McClellan's supplement offered new opinions, and that the *Pennypack* factors supported the extreme sanction of striking his testimony, the district court abused its discretion by failing to consider a lesser sanction. *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 793 (3d Cir. 1994) (finding an abuse of discretion for failing to consider a lesser sanction, such as allowing additional limited expert discovery and taxing costs to the plaintiff). This is particularly true in the case of a bench trial. *Meyers v. Pennypack Woods Home Ownership Assn.*, 559 F.2d 894, 905 (3d Cir. 1977) ("we believe a less drastic sanction, especially since it was a bench trial, should have been adopted").

Here, the district court cited only paragraphs 24, 25 and 26 of McClellan's supplement as containing "new" opinions. But the district court struck the *entirety* of the supplement, even the portions that simply repeated the district court's claim construction, quoted portions of McClellan's deposition and Storms' deposition transcript, and pasted excerpts from McClellan's original reports. In doing so, the district court made broad statements that the entire supplement "offer[ed] new legal theories and opinions," and sweeping characterizations McClellan's "previous opinions" which led to the flawed findings regarding "inconsistencies"



in McClellan’s testimony. Appx92-97. While briefly acknowledging a less severe solution existed (i.e. BearBox’s suggestion to allow Lancium a rebuttal supplement), the district court quickly dismissed it as too disruptive, deploying the harshest sanction under the circumstances. Appx96.

The district court’s failure to implement, or even seriously consider, less extreme sanctions or remedies, like a Lancium rebuttal supplement, a McClellan deposition before trial, a short delay of the trial, or simply allowing Lancium to cure any prejudice through cross-examination, is another abuse of discretion. *Sheehan v. Delaware & Hudson Ry. Co.*, 439 F. App’x 130, 133 (3d Cir. 2011) (“the District Court did not abuse its discretion in finding that [the opposing party] could cure any prejudice through cross-examination”).

**IV. The district court erred by failing to consider and even excluding Storms’ conception testimony, failing to consider claim elements in combination, and misapplying the Rule of Reason**

The purported inventor’s story is central to the conception inquiry. *Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1363 (Fed. Cir. 2023) (a proper rule of reason analysis is “aimed at determining whether [the purported inventor’s] story is credible overall.). This includes both a purported inventor’s testimony about his conception, as well as the communication of his ideas to the defendant. *Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1364 (Fed. Cir. 2023)

(“[A]n analysis of corroboration that considers conception and communication together. Indeed, the same evidence can be relevant to both”).

Storms testified at trial about his conception of the subject matter claimed in the ’433 patent. He attempted to testify about the substance of his communication of those ideas to Lancium. The former was not considered by the district court in its analysis and the latter was excluded as hearsay.

**A. The district court erred in excluding portions of Storms’ testimony as hearsay and failing to consider Storms’ testimony**

Lancium objected to Storms testifying about what he communicated to Lancium at a cocktail hour and dinner as “classic hearsay.” Appx8025-8026(79:24-82:9). Counsel for BearBox argued that the testimony was not offered for the truth of the matter asserted, but only for the sake of proving notice and what information Storms communicated to Lancium. Appx8025(80:4-81:20). The district court sustained the objection, ruling that Storms could not “get into the details of that communication.” Appx8025(81:25-82:1).

The district court erred in excluding Storms’ testimony about his oral communications with Lancium because the out-of-court statements were not offered for the truth of the matter asserted. Testimony about the substance of communications is relevant to both conception of the claimed invention and the communication of those inventions to the defendants. *REG Synthetic Fuels, LLC v. Neste Oil Oyj*, 841 F.3d 954, 964 (Fed. Cir. 2016) (such testimony is “not hearsay

because the communication of the idea had legal significance as the basis for the conception of the invention”). Here, the declarant was in court to testify as to the information he communicated to Lancium, and Lancium would have had an opportunity to cross-examine him on whether he actually communicated that information. BearBox sought to introduce the substance of the communications, however, not for its truth, but to prove what information was communicated.

That error was compounded by the district court allowing, and relying upon, Lancium’s testimony about the substance of the very same communications with Storms. For example, during trial McNamara was asked whether Storms communicated certain technical information during dinner, which McNamara denied. Appx8148(562:25-563:2) (Q. Did you and Mr. Storms ever discuss ERS, demand response programs or ancillary service? A. No, we did not.”). The district court credited McNamara’s one-sided testimony in concluding that “as a matter of fact [] Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter claimed in the ’433 patent to McNamara ... during the May 3, 2019, dinner.”). Appx21 ¶66.

The district court allowed Storms to testify to other aspects of his conception of the claimed inventions. That testimony appears on 31 pages of trial transcript. Appx8017-8024(46:16-77:17). While the district court did cite in its Findings of Fact some of Storms’ conception testimony, it amounted to just two pages of

transcript, and even those two pages were not relied upon in the district court's analysis of the conception or communication of the claimed inventions. Appx11-12 ¶¶35, 37.

The district court instead analyzed Storms' conception of the claimed inventions by reviewing certain of Storms' corroborating documents one at a time, in isolation. Appx32-33 ¶101 ("The Court finds as a matter of fact that Storms' Diagram does not meet element [b2] of claim 1 of the '433 patent"); Appx33 ¶102 ("... the BearBox Spec Sheet does not meet element [b2]..."); Appx34-35 ¶105 ("... Storms' Data File does not meet element [b2]..."). Not only did the district court err in its piecemeal evaluation of BearBox's corroborating documents, it erred in its failure to consider Storms' conception story at all. "At bottom, the goal of the analysis is to determine 'whether the inventor's story is credible.'" *NFC Tech., LLC v. Matal*, 871 F.3d 1367, 1372 (Fed. Cir. 2017).

**B. The district court erred in its element-wise attack on Storms' conception when it should have considered the elements in combination**

The district court also erred by analyzing individual claim elements (rather than combinations of elements) by comparing them, element-by-element, to a select few of Storms' corroborating documents (also evaluated one at time rather than collectively) to determine whether Storms' conception of the subject matter claimed in the '433 patent was corroborated.

This Court “ha[s] repeatedly rejected an element-wise attack on corroboration” and has stated “in clear terms” that it would not matter if “none of the corroborating evidence constitutes definitive proof of [a purported inventor]’s account or discloses each claim limitation as written” because “the corroboration requirement has never been so demanding.” *TransWeb, LLC v. 3M Innovative Properties Co.*, 812 F.3d 1295, 1302 (Fed. Cir. 2016); *see also Intell. Ventures II LLC v. Motorola Mobility LLC*, 692 F. App’x 626, 628 (Fed. Cir. 2017) (Such an “overly-narrow, element-focused attack [i]s improper because it is inconsistent with the required rule of reason analysis.”); *Ohio Willow Wood Co. v. Alps South*, 735 F.3d 1333, 1348 (Fed. Cir. 2013). As this Court recently emphasized, it is “not the significance of certain elements standing alone” that “matters for determining inventorship,” instead, “[t]he proper lens requires considering the elements in combination, not in isolation.” *Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1362 (Fed. Cir. 2023).

Here, the district court failed to consider claim elements in combination, instead focusing on individual elements when evaluating whether Storms conceived of the claimed inventions. Section F of the district court’s opinion is even titled “Conception of the *Elements* of the ’433 Patent” and includes sub-headings for each disputed claim element (*e.g.*, “Elements [b] and [b1],” “Element [b2],” “Element [b3],” “Element [b4]”), under which the court analyzes the claim

elements, one at a time, to determine whether a select few of Storms' corroborating documents, when viewed alone, disclose each respective claim element. Appx30 (emphasis added).

For example, for element [b2] of claim 1 of the '433 patent, the district court first notes that "[t]he parties dispute whether Storms' Diagram, the BearBox Spec Sheet, *or* Storms' Data File meets element [b2]." Appx32 (emphasis added). The court proceeds to evaluate those three documents, one at a time, and states why "as a matter of fact" each document, when viewed alone, "does not meet element [b2] of claim 1 of the '433 patent." Appx32-34. And "[b]ased on these findings" alone, without considering other elements in combination, or any of the dozens of other corroborating documents and contemporaneous communications in evidence as a collective, the district court "finds as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms conceived of element [b2] of claim 1 of the '433 patent." Appx35.

The district court analyzes elements [b3] and [b4] the same way, making similar findings "as a matter of fact" without considering any other claim elements in combination. Appx36-39 ¶¶107-114. The district court applied the same type of element-by-element analysis with respect to all remaining claims before concluding that Storms did not conceive of certain claim elements or did conceive of other elements but did not communicate them to Lancium prior to Lancium's

own independent conception. These flawed analyses are relied upon throughout the district court's opinion, including the dependent claims. Appx40 (finding Storms Email "does not meet claim 3 ... because the Court has already found" it does not meet "element [b2]").

The district court applied the same flawed analysis in concluding that Lancium had "independently conceived" of various individual elements before Storms, yielding strange results, like the district court's conclusion that Storms had conceived of the background element "a control system," but not before Lancium had "independently conceived" of a control system "no later than January 2018." Appx30-31. Neither BearBox nor Lancium alleged a conception date for this single component of the prior art in isolation.

More importantly, the district court's approach credited Lancium with conception dates for individual elements that, when properly combined, not even Lancium believed it deserved. Specifically, Lancium admitted that it did not conceive of the full combination of elements claimed in the '433 patent until August 2019 to October 2019, months after Storms' alleged conception. Appx8874. Lancium also admitted it did not conceive of certain elements, and *sub-combinations including those elements* until August to October 2019.

other limitations (e.g., those limitations relating to "power option agreements," "power option data," "responsive to receiving the power option data, determining a performance strategy ..."), and/or

combinations of the limitations were conceived and reduced to practice between approximately August 2019 and October 2019

Appx8855. Further, throughout discovery and at trial, Lancium’s expert Ehsani identified a document he called the “flash of insight,” which in his opinion led to Lancium’s independent conception of the claimed inventions. The “flash of insight” is dated August 27, 2019. Tr. 695:20-696:6.

Despite these admissions, the district court’s flawed element-by-element approach credited Lancium with independent conception of the “determining a performance strategy” limitation “no later than October 2018,” nearly a full year earlier. Appx31 ¶¶97, 98. Similarly, the “determining a performance strategy” limitation, is combined with the “monitor a set of conditions” limitation: “performance strategy ... based on at least one condition in the [monitored] set of conditions.” ’433 Patent, Claim 1. But by Lancium’s own admission, it did not conceive of this sub-combination until August 2019 to October 2019. Appx8923-8994. The district court, however, found that Lancium conceived of the “monitored set of conditions” limitation, in isolation, by January 2018, nineteen months before Lancium’s earliest contended conception. Appx31 ¶¶97, Appx8923-8994.

In support, the district relied *only* on Cline’s “credible” testimony in finding that “by the time the ’632 Application was filed, Lancium monitored various conditions including receiving information on forecasts affecting the price of



power and ‘economic considerations,’ such as the real-time price of power, the price of Bitcoin, and other information enabling Lancium to determine whether it was profitable to mine.” Appx17 ¶56, Appx31 ¶97. Cline’s credibility was impugned at trial, which was partially, though not entirely, recognized by the district court. The district court found that Cline testified that he “did not recall” whether he downloaded Storms’ Data File. Appx27 ¶85. But that was Cline’s *deposition* testimony. At trial, Cline changed his testimony to distance himself from the evidence stating that he *did* download the Data File *but not until April 2021*, after the lawsuit was filed. No such file with April 2021 metadata was produced by Lancium in discovery, and Cline’s testimony was contradicted by metadata Lancium did produce which showed Cline downloaded the file on May 9, 2019. Appx8136(Tr. 518:4-19).

Many of the district court’s “prior independent conception” findings were based on the same uncorroborated testimony from a purportedly credible witness, in conflict with other evidence of record. This is error. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1375 (Fed. Cir. 1986) (“a trial judge may not ‘insulate his findings from review by denominating them credibility determinations’; if documents or objective evidence contradict the witness's story, clear error may be found even in a finding purportedly based on a credibility determination.”); *Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1362

(Fed. Cir. 2023) (“we reject Blue Gentian's arguments about Mr. Berardi's prior conception because Blue Gentian does not point to evidence that he conceived of all three contributed elements before the August 2011 meeting.”).

**C. The district court erred in its application of the Rule of Reason by evaluating corroborating documents piecemeal or not at all**

This Court has emphasized that the Rule of Reason looks at corroborating evidence “taken as a whole,” and, thus, it is error to evaluate documents in isolation. *TransWeb, LLC v. 3M Innovative Props.*, 812 F.3d 1295, 1302 (Fed. Cir. 2016)). The district court referenced the Rule of Reason only when reciting applicable legal standards. Appx54. However, the district court did not address whether, under the Rule of Reason, the totality of the evidence, “including circumstantial evidence, support[s] the credibility of the inventors’ story.” *E.I. Du Pont De Nemours & Co. v. Unifrax I LLC*, 921 F.3d 1060, 1077 (Fed. Cir. 2019).

Further, instead of analyzing what the evidence did show, the district court's analysis focused on what it allegedly did not, singling out claim limitations that *individual* documents purportedly did not explicitly disclose. This Court has cautioned against doing this very thing. *See Perfect Surgical Techniques v. Olympus America, Inc.*, 841 F.3d 1004, 1011-12 (Fed. Cir. 2016). The district court may not use piecemeal attacks on a small portion of the corroborating evidence in reaching its conclusions. *See Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1364 (Fed. Cir. 2023) (rejecting “attempts to cast doubt on the

corroborative power of the '836 patent, the prototype, and other witness testimony individually. . . [because] these arguments ignore that corroboration is based on evaluation of the evidence as a whole”).

For example, the district court’s finding that Storms did not conceive of a system that would turn individual miners on and off and thus did not conceive of element [b4], is illustrative of the mistake that permeated the district court’s analysis. Appx38-39 ¶113 (the district court found “Storms’ Source Code ‘only ever instructs ... all the relays of the PDUs to turn on or off.’”).<sup>1</sup>

The district court confirmed that through late-2018 into early 2019, prior to meeting Lancium, “Storms began to design, build, and test a system of relays, [PDUs], and a computer user interface that allowed a remote user to control *individual relays so that miners could be turned on and off.*” Appx10 ¶29. In reaching this conclusion, the district court relied on Storms’ testimony, Appx8017-8018(Tr. 46:52-52:13), and corroborating evidence, including photos of Storms’ hardware and graphic interfaces. Appx9412-9413, Appx9414-9415, Appx9416-9417, Appx9418-9419, Appx9420-9421, Appx9422-9423, and Appx9424-9425;

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<sup>1</sup> Even if Storms proved only that he possessed the concept of *all* miners on and off, that still satisfies the “instructions to the set of computing systems” limitation. ’433 Patent, Claim 1, [b4]. Similarly, the district court’s misapplication of this of claim scope is problematic for claim 16, which recites instructions to “at least a subset” of computing systems. Turning on or off all the miners is still “at least a subset” of miners.

Appx10. But later in its opinion, when analyzing corroboration, the district court reverses course stating that “Plaintiffs did not otherwise proffer evidence establishing that the BearBox system could individually control the system of 272 miners” and, therefore, “Storms’ Email does not meet element [b4] of claim 1 of the ’433 patent” or establish conception of element [b4]. Appx38-39 ¶¶113-114.

In reaching that second, contrary finding the district court did not consider the same corroborating evidence (contemporaneous photos, graphic interfaces, etc.) that it relied on in initially finding that Storms’ BearBox System *did* allow a remote user to control individual relays. The district court further failed to consider Storms’ Email together with other corroborating evidence, e.g. contemporaneous communications with third parties like Mr. Ben Hakes, or the substance of his texts with McNamara and the circumstances surrounding those messages (e.g. the timing of the messages or the substance and timing of Lancium’s internal, contemporaneous communications regarding features embodying the claimed inventions). Appx8019-8021(56:12-65.1), Appx8021(65:13-24), Appx8022(66:11-67:18), Appx8943, Appx8947, Appx8949, Appx8950, Appx9434-9435; see *Martek Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363, 1375 (Fed. Cir. 2009) (“Documentary or physical evidence that is made contemporaneously with the inventive process provides the most reliable proof that the inventor's testimony has been corroborated.”); Appx10-12 ¶¶30-37. In doing so, the district court

“ignored[d] that corroboration is based on evaluation of the evidence as a whole.”

*Id.* (citing *Fleming v. Escort Inc.*, 774 F.3d 1371, 1377 (Fed. Cir. 2014)).

**D. The district court erred in holding BearBox’s corroborating evidence to a heightened standard beyond what is required for conception**

The district court repeatedly criticized BearBox’s corroborating evidence as not *actually performing* each claim element. Appx38-39 ¶113, Appx42-43 ¶125, Appx50-51 ¶144 (“Plaintiffs did not otherwise proffer evidence establishing that the BearBox System could individually control the system of 272 miners”). But proving reduction to practice is not required for conception.

Conception is mental. It “is the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention.” *Invitrogen Corp. v. Clontech Labs., Inc.*, 429 F.3d 1052, 1063 (Fed. Cir. 2005). “An idea is sufficiently definite and permanent for conception if it provides one skilled in the art with enough guidance to ‘understand the invention.’” *Id.* at 1063 (quotations omitted). “[A]n inventor need not know that his invention will work for conception to be complete, but rather need only show that he had the idea; the discovery that an invention works is part of its reduction to practice.” Appx53 (citations omitted). Although the district court acknowledged that “the discovery that an invention works is part of its reduction to practice,” not part of its conception, reduction to practice is exactly what the district court required.

Notably, the district court misstates the law in *Medichem*, stating an “inventor must independently corroborate its alleged conception through ‘testimony of a witness . . . to the actual reduction to practice,’ or ‘evidence of surrounding facts and circumstances independent of information received from the inventor.’” Appx53 (citing *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1171 (Fed. Cir. 2006)). In *Medichem*, however, the alleged inventor attempted to prove reduction to practice of the invention, not conception. *Medichem*, 437 F.3d at 1169. This Court in *Medichem* recognized “the standard of proof required to corroborate a reduction to practice [is] more stringent . . . than that required to corroborate a conception.” *Id.* at 1170.<sup>2</sup>

Here, Storms’ simulation corroborates Storms’ *conception* of his ideas. BearBox need only show that Storms had “a definite and permanent idea” of the claimed invention, such that “it provides one skilled in the art with enough guidance to ‘understand the invention.’” *Invitrogen Corp.*, 429 F.3d at 1063 (quotations omitted). Corroboration of Storms’ conception “does not require that every detail. . . be independently and conclusively supported by explicit

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<sup>2</sup> *Martek Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363, 1376 (Fed. Cir. 2009) (“[T]o corroborate a reduction to practice, [we apply] a more stringent standard than that required to corroborate a conception. Indeed, a notebook page may well show that the inventor *conceived* what he wrote on the page, whereas it may not show that the experiments were *actually performed*, as required for a reduction to practice.”).

disclosures in the pre-critical date documents or physical exhibits.” *Ohio Willow*, 735 F.3d at 1348; *see also Lazare Kaplan Int’l, Inc. v. Photoscribe Techs., Inc.*, 628 F.3d 1359, 1373-74 (Fed. Cir. 2010); *Ethicon, Inc. v. United States Surgical Corp.*, 35 F.3d 1456, 1464 (Fed. Cir. 1998) (“[T]here need not be corroboration for every factual issue contested by the parties.”). And a simulation or prototype of a claimed invention need not practice each claim element to be valuable corroborating evidence. *Blue Gentian, LLC v. Tristar Prod., Inc.*, 70 F.4th 1351, 1363 (Fed. Cir. 2023).

Storms conceived of individual miner control evidenced by his description of “relay mapping,” and his graphic interfaces showing control of individual miners or groups of four miners. Another graphic depicted two miners on and 22 miners off. That Storms simulated the maximum load of all miners on or off should not limit the concept he mentally possessed, nor could it if all the corroborating evidence was evaluated together, as a whole, to verify his story.

The district court repeatedly held BearBox’s corroborating evidence to this heightened standard, finding that BearBox did not proffer evidence that the BearBox System *could actually practice* claim elements. Some examples, include:

- “The Court finds as a matter of fact” that Storms did not conceive of element [b4] of claim 1, claim 4, or claim 16 because “Plaintiffs did not otherwise proffer evidence establishing that the **BearBox System could** individually control the system of 272 miners.” Appx38-39, Appx42-43, Appx50-51.

- “[T]here is no indication that the **BearBox System could** remotely control individual miners.” Appx38-39.
- “see also Appx8042(149:6-9), which belies any assertion that the **BearBox System could** determine a power consumption target equal to or greater than the minimum power threshold.” Appx36.
- “. . . belies Storms’ assertion that the **BearBox System could** increase the frequency at which the miners operate.” Appx48-49.

See also Appx15, Appx36-37.

As a result, the district court reached the flawed conclusion that Storms did not conceive, or contribute to the conception of, the claimed subject matter.



## CONCLUSION

For all of the foregoing reasons, Plaintiffs-Appellants request that this Court vacate the district court's final judgment and remand for further proceedings including a new trial on inventorship and conversion.

Date: August 25, 2023

Respectfully submitted,

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**ADDENDUM**

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**IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE**

BEARBOX LLC and AUSTIN STORMS,

Plaintiffs,

v.

LANCIUM LLC, MICHAEL T.  
MCNAMARA, and RAYMOND E.  
CLINE, JR.,

Defendants.

C.A. No. 21-534-GBW

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Andrew C. Mayo, ASHBY & GEDDES, Wilmington, Delaware; Benjamin T. Horton, John R. Labbe, Raymond R. Ricordati III, Chelsea M. Murray, MARSHALL, GERSTEIN & BORUN LLP, Chicago, Illinois

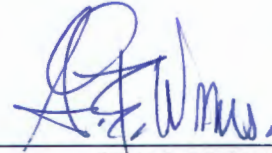
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**OPINION**

March 6, 2023  
Wilmington, Delaware



GREGORY B. WILLIAMS  
UNITED STATES DISTRICT JUDGE

The Court held a three-day bench trial on the issue of correction of inventorship brought by Plaintiffs BearBox LLC and Austin Storms (collectively, “Plaintiffs” or “BearBox”).<sup>1</sup> *See* D.I. 103. Plaintiffs alleged at trial that (1) Storms is the sole inventor of United States Patent No. 10,608,433 (“the ’433 patent”) and, thus, the ’433 patent must be corrected to list Austin Storms as the sole inventor; or (2) alternatively, Storms is a joint inventor of some claimed subject matter of the ’433 patent and, thus, the ’433 patent must be corrected to list Austin Storms as a joint inventor. The parties have submitted post-trial briefing, *see, e.g.*, D.I. 256; D.I. 258; D.I. 260; D.I. 261, and proposed findings of fact, *see, e.g.*, D.I. 257; D.I. 259.

The Court has separately set forth its findings of fact and conclusion of law as required by Federal Rule of Civil Procedure 52(a)(1).

## **I. FINDINGS OF FACT<sup>2</sup>**

### **A. The Parties**

1) Plaintiff Austin Storms (“Storms”) is the founder and sole employee of BearBox LLC. Tr. 106:22-107:2. Storms is a college graduate with a degree in geology and geographic information systems. Tr. 42:13-43:20; Tr. 110:10-12. Storms is currently employed by Galaxy Digital as the Vice President of Mining Operations, *see* Tr. 109:14-16, and has previously worked

<sup>1</sup> In response to the Operative Complaint, *see* D.I. 103, Defendants filed counterclaims for declaratory judgment that Austin Storms is not an inventor of the ’433 patent (Count I) and declaratory judgment that BearBox has no ownership rights in the ’433 patent (Count II). *See* D.I. 145. Defendants’ declaratory judgment counterclaims rise and fall with Plaintiffs’ claims of sole and joint inventorship.

<sup>2</sup> The Court’s Findings of Fact are cited as “FF ¶ \_\_\_\_.”

for Great American Mining. Tr. 109:2-13. At the time this case was filed, Storms was a citizen of Louisiana. *See* D.I. 239-1, Ex. 1 at ¶ 2.

2) Plaintiff BearBox LLC (“BearBox”) was founded by Storms in late 2018 to design and develop mobile cryptocurrency datacenters. Tr. 46:16-47:24; Tr. 106:22-107:2. BearBox is a Louisiana limited liability company with a principal place of business at 4422 Highway 22, Mandeville, Louisiana 70471. *See* D.I. 239-1, Ex. 1 at ¶ 1. BearBox has only ever sold one of its BearBox mobile cryptocurrency datacenter containers and did not turn a profit. Tr. 132:7-11. Today, BearBox manufactures no products, has one employee, i.e., Storms, and has no assets. Tr. 110:1-7.

3) Defendant Michael McNamara (“McNamara”) is the Chief Executive Officer and co-founder of Lancium LLC. Tr. 532:25-533:3. McNamara is a resident of Newport Beach, California. *See* D.I. 239-1, Ex. 1 at ¶ 4; Tr. 532:23-24.

4) Defendant Raymond Cline, Jr. (“Cline”) is a co-founder of Lancium LLC. Tr. 435:23-25. Cline has a B.S. degree in chemistry and a Ph.D. in chemical physics, *see* Tr. 432:6-7; Tr. 432:12-16, and has experience with computer programming and smart grid technology. Tr. 432:17-434:2. Cline personally mined the cryptocurrency “Bitcoin” between 2015 and 2017. Tr. 434:3-435:22. Cline is a resident of Houston, Texas. *See* D.I. 239-1, Ex. 1 at ¶ 5.

5) Defendant Lancium LLC (“Lanium”) was founded in November 2017. Tr. 436:12-14; Tr. 533:4-5. Lancium is a Delaware limited liability company with its principal place of business at 6006 Thomas Road, Houston, Texas 77041. *See* D.I. 239-1, Ex. 1 at ¶ 3. Lancium’s operations predominately stem from its Thomas Road R&D Facility in Houston, Texas. Tr. 448:24-450:3-21.



## **B. The Parties' Witnesses**

### **1. Plaintiffs' Witnesses**

#### **a. Fact Witnesses**

- 6) Austin Storms.

#### **b. Expert Witnesses**

7) Dr. Stanley McClellan ("Dr. McClellan") is a professor of electrical and computer engineering at the Ingram School of Engineering, Texas State University. TX-19; Tr. 267:24-268:1. Dr. McClellan is an expert in distributed energy systems and smart grid technology. Tr. 271:7-274:24.

8) Frank McCamant ("McCamant") is an expert in electric utilities and ERCOT electricity markets. TX-983; Tr. 179:22-180:2. McCamant owns and operates McCamant Consulting, an Austin, Texas based firm that advises public and private entities on power development projects and the ERCOT market. Tr. 172:3-179:25.

### **2. Defendants' Witnesses**

#### **a. Fact Witnesses**

- 9) Michael McNamara.

- 10) Raymond Cline, Jr.

11) Denis Labij ("Labij") is the current Vice President of Power Markets at GlidePath, and previously served as a GlidePath business development lead. Tr. 607:19-608:4. Labij was introduced to Storms through Benjamin Hakes, *see* Tr. 608:8-21, and discussed topics related to power markets with Storms. Tr. 608:14-622:5; TX-146.

12) Benjamin Hakes ("Hakes") was a project management consultant at GlidePath. Tr. 624:4-7. Hakes first contacted Storms through Twitter due to their mutual interest in Bitcoin. TX-

15; Tr. 624:11-625:3. Hakes and Storms have never met in person, but have communicated via email, text message, and phone calls. Tr. 625:8-626:13.

#### **b. Expert Witnesses**

13) Nikolaus Baer (“Baer”) is an expert in software and source code development and analysis. Tr. 642:8-10. Baer holds a Bachelor of Science degree in computer engineering, has extensive experience in the computer code languages Python, C, C++, and JAVA, and is the founder of Baer Consulting, a firm which provides services for examining, analyzing, and developing software and source code. Tr. 638:7-642:7; TX-829.

14) Dr. Mark Ehsani (“Dr. Ehsani”) is an expert in electrical engineering, including power control of datacenters and power markets. Tr. 678:12-15. Dr. Ehsani is currently the Robert M. Kennedy Professor of Electrical and Computer Engineering at Texas A&M University and is a distinguished lecturer at the Institute of Electrical and Electronics Engineers. Tr. 674:11-678:11; TX-831. Plaintiffs did not contest that, as related to the ’433 patent, Dr. Ehsani is a person of ordinary skill in the art. Tr. 276:14-277:1.

#### **C. The Invention at Issue**

15) United States Patent No. 10,608,433 (“the ’433 patent”) is titled “Methods and Systems for Adjusting Power Consumption Based on a Fixed Duration Power Option Agreement,” and was issued by the United States Patent and Trademark Office (“USPTO”) on March 31, 2020. *See generally* ’433 patent<sup>3</sup>; *see also* D.I. 239-1, Ex. 1 at ¶ 6. The ’433 patent lists Michael McNamara and Raymond Cline, Jr. as the inventors. *See* ’433 patent at Cover.

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<sup>3</sup> Although the ’433 patent was admitted into evidence as TX-1, the Court will cite to the patent rather than the exhibit.



16) The '433 patent issued from United States Patent Application No. 16/702,931, which was filed on December 4, 2019. *See* D.I. 239-1, Ex. 1 at ¶ 7; *see* '433 patent at Cover. The '433 patent claims priority to United States Provisional Patent Application No. 62/927,119 ("the '119 Application"), which was filed on October 28, 2019. D.I. 239-1, Ex. 1 at ¶ 6; *see* '433 patent at Cover.

17) The '433 patent relates to a set of computing systems that are configured to perform computational operations using power from a power grid. *See* '433 patent at 5:48-49. The '433 patent also relates to a control system that monitors a set of conditions, receives power option data that is based, at least in part, on a power option agreement, which specifies minimum power thresholds associated with time intervals. *See id.* at 5:50-55. The set of computing systems may also determine a performance strategy for a load based on a combination of the power option data and one or more monitored conditions. *Id.* at 5:55-60. The performance strategy may specify a power consumption target for the load for each time interval such that each power consumption target is equal to or greater than the minimum power threshold associated with each time interval. *Id.* at 5:60-6:13. More so, the computing systems may provide instructions the set of computing systems to perform one or more computational operations based on the performance strategy. *See id.* at 6:14-65.

18) The '433 patent has twenty (20) claims. *See* '433 patent at claims.

19) Plaintiffs contend, *see* D.I. 256 at 6, and Defendants do not dispute, *see* D.I. 258 at 9 n.4, that independent claims 1, 17, and 20 of the '433 patent contain substantially the same claim limitations, except that claims 17 and 20 do not require using power from a grid. *See* '433 patent at claim 17, 20. When discussing the independent claims of the '433 patent, rather than shift

between claims 1, 17, and 20, the Court will, unless otherwise indicated, substantively discuss only independent claim 1 of the '433 patent.

20) Claim 1 of the '433 patent reads:

1. A system comprising:

[a] a set of computing systems, wherein the set of computing systems is configured to perform computational operations using power from a power grid;

[b] a control system configured to:

[b1] monitor a set of conditions;

[b2] receive power option data based, at least in part, on a power option agreement, wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;

[b3] responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions, wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and

[b4] provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.

*See* '433 patent at claim 1.

21) For ease of reference, the Court will follow the parties' practice at trial and throughout the post-trial briefing by referring to each element of claim 1 by the associated label above, *e.g.*, "[b1]," "[b2]," etc.



22) The parties do not dispute that a person of ordinary skill in the art (“POSA”) is one who holds a degree in electrical engineering, computer science, or a similar field and has one to two years of experience in the field of software or an equivalent level of experience, or a bachelor’s degree in electrical engineering, computer science, or a similar field, plus at least two years of experience designing and/or implementing power control systems for datacenters. Tr. 276:14-277:3.

#### **D. Energy and ERCOT Markets<sup>4</sup>**

23) The electrical grid is an interconnected system of generators, transmitters, and consumers that must be managed to ensure reliability. Tr. 180:8-25. A consumer of electricity is called a “load.” Tr. 181:1-6. A manager of an electrical grid is called an “independent system operator,” or “ISO.” Tr. 181:15-25. ISOs manage the electrical grid by creating and managing energy markets to ensure a balance between supply and consumption (by the load) of power. A form of balance that ISOs utilize are called “ancillary services,” which are a type of demand response that provide capacity reserves to ensure that the system capacity meets the system demand for electricity or power. Tr. 188:7-189:19, 206:7-10, 207:16-20.

24) The Electric Reliability Council of Texas (“ERCOT”) is an ISO that operates a day-ahead energy market (“DAM”) for buyers and sellers of energy that is voluntary, but financially binding. Tr. 202:8-11, 202:18-20. If a load buys energy in the DAM, it must pay for that energy, but it does not have to use that energy. Tr. 203:4-24. Instead, the load could sell that power in the real-time energy market (“RTM”), which is called “sell-back.” Tr. 203:15-20, 203:25-204:13.

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<sup>4</sup> McCamant testified about the general nature and functionality of energy grids and the ERCOT market. Tr. 179:22-180:2. The Court finds this testimony credible and, therefore, relies on it.

25) ERCOT's energy markets are different markets than ERCOT's ancillary services market. Tr. 201:19-21. ERCOT's ancillary services market gives ERCOT the ability to decrease the amount of energy being used by participating loads. Tr. 207:4-7. A qualified scheduling entity ("QSE")—which is a required entity in the ancillary services market that acts as an intermediary between ERCOT and the load—submits an ancillary services offer and is granted an "award," which specifies minimum amounts of power the load has to use during specific time intervals during the operating day. Tr. 189:24-190:13; Tr. 192:6-11. Thereafter, the load is obligated to use, i.e., it cannot "sell-back," the amount of energy that is subject to the award, even if it is unprofitable to use the energy. Tr. 208:9-209:22; *see also* Tr. 207:25-208:8. A load that receives an ancillary services award is compensated by a "capacity payment," regardless of whether the load's power consumption is curtailed by ERCOT. Tr. 207:8-11, 209:23-210:9, 212:5-16; *see also* Tr. 190:14-24. ERCOT's ancillary services market has existed since early 2000. Tr. 194:1-3.

26) A controllable load resource ("CLR") is a participant in the ancillary services market and can submit ancillary services offers in incremental amounts of power. Thus, a CLR can incrementally reduce its power consumption rather than simply shutting the load completely off when curtailed by ERCOT. Tr. 194:9-198:24.

## **E. Timeline of the Parties' Relationship and Communications**

### **1. Storms – Pre-FCAT Mining Summit**

27) In 2017, Storms designed and built a half-megawatt datacenter for Bitcoin mining in his father's karate studio, but Storms' implementation was unprofitable due to the price of electricity. Tr. 43:21-46:6.

28) By late-2018, Storms began developing shipping containers that would house cryptocurrency miners, with the intention that such containers could be placed anywhere and be



controlled remotely. Tr. 47:14-52:4. Storms' development (the "BearBox System") led to the founding of BearBox LLC. Tr. 40:17-25; Tr. 47:3-13.

29) Through late-2018 into early 2019, Storms began to design, build, and test a system of relays, power distribution units ("PDUs"), and a computer user interface that allowed a remote user to control individual relays so that miners could be turned on and off. Tr. 46:52-52:13; *see, e.g.*, TX-128; TX-129; TX-130; TX-131; TX-132; TX-134; TX-138. Storms developed the BearBox System in his apartment and in the workshop of Jason Hutzler, an electrician and friend of Storms. Tr. 52:3-4; *see also* Tr. 48:24-49:10.

30) Around November 26, 2018, Storms met Benjamin Hakes, a representative at GlidePath, through Twitter. Tr. 56:12-58:8; TX-15 at 4. GlidePath is a wind asset and battery asset-generated developer, not a Bitcoin mining company. Tr. 58:1-8. Storms and Hakes began discussing how GlidePath could develop a system that mined cryptocurrency when electricity prices are low but sold wind energy to the grid when prices are favorable. Tr. 58:9-60:4. By December 10, 2018, Storms had signed a non-disclosure agreement with GlidePath. *See* TX-932.

31) On November 28, 2018, Hakes explained to Storms the concept of "behind the meter," TX-932 at 10001043, which means that the load is connected directly to a power generation entity, i.e., a wind farm, and transmits power to the load before transmitting power to the grid. Tr. 439:17-440:1. Between November 2018 and April 2019, Hakes also explained the meaning of locational margin price ("LMP"), power purchase agreement ("PPA"), and day-ahead price. *E.g.*, TX-14 at 21-22. LMP correlates to the price that a generator receives for selling power to the grid in a specific location, *see* TX-14 at 21, which Storms agreed is "shorthand" for the price of power. Tr. 60:23-61:4.

32) On April 5, 2019, Hakes wrote to Storms:

It'll be super cool to write a little Python script that ran on the UPS at the mining site that looked at the LMP, locational marketing price, pricing at the wind farm feed and power on/off based on whether or not the LMP is above or below, so \$0.03 per kilowatt hour.

*See* TX-14 at 21; Tr. 59:7-18, 60:23-61:4.

33) Storms then began to write source code for his BearBox system, *see* Tr. 52:14-24, and brainstormed the functionality of his source code on whiteboards ("Storms' Source Code").

*See, e.g.*, TX-20; TX-24; TX-32; TX-46; TX-47; TX-48; TX-49; TX-139; TX-140; TX-144.

34) On April 11, 2019, Storms wrote to Hakes:

Let's talk some about the LMP check when you get a chance – I think I can model profitability of mining with LMP logic over a week or so vs. just selling @ LMP. If so, that's a game changer and we can develop it together to sell the system or full IP to the highest bidder. And realistically, the model will use on-site mining data with price API data to dynamically calculate what LMP selling power back to the grid is more profitable than mining. That's the real [arbitrage].

*See* TX-14 at 25.

35) Storms testified that he "wanted to talk to [Hakes] about the LMP check, because [he] thought that there was a way that [he] figured out [the profitability] of mining with the LMP logic over a week or so versus just selling power at the LMP. So you could dynamically compare the two and that realistically the model that [he] was working on at the time would use the onsite mining data and the Bitcoin price API data to calculate that profitability threshold or that LMP number." Tr. 60:9-17. Storms further testified that he believed this was "the real arbitrage opportunity," *see* Tr. 62:13, because "it would allow units of electricity to be sold at the most opportunistic price. This would be the arbitrage, that is the units of electricity price in the Bitcoin that they would mine in dollars versus being able to sell that back to the grid in dollars." Tr. 62:19-24.



36) On April 19, 2019, Storms sent a text message to Hakes that included an annotated diagram titled “BearBox Automatic Miner Management System Version 1.0.” TX-14 at 26-27. At trial, Storms explained that this annotated diagram illustrated his BearBox System, which embodied a scenario where the power entity would either use the generated power or sell that power to the grid at the real-time LMP price based on the price of power. Tr. 63:13-65:1; TX-14 at 27.

37) On April 23, 2019, Storms told Hakes that he “got the model running,” and “[t]his is one of the coolest things I’ve ever put together FYI – thanks for the idea.” TX-14 at 28. Storms explained to Hakes that his model compared “real time LMP vs. network hashrate profitability in 5 min increments.” *Id.* At trial, Storms testified that the 5-minute intervals correlated to the frequency that the code would compare “mining versus what would be selling back power to the grid, if you were a generation asset owner.” Tr. 67:3-11.

38) On April 24, 2019, Storms emailed Labij with questions related to energy markets, because Storms “didn’t understand a few things about the market.” TX-146; Tr. 72:8-73:8. At the time, Labij was “one of the power market guys at GlidePath.” Tr. 72:13-14.

39) Labij responded on April 25, 2019, and described how Storms’ Source Code could analyze profitability for Bitcoin mining. TX-962. Labij explained to Storms the need to calculate a Bitcoin breakeven price, how to calculate the revenue that could be earned by selling back power in the real-time market, and how to compare the profitability of mining Bitcoin to selling-back power in the real-time market. *See* TX-962; Tr. 610:8-619:10.

40) Storms responded on April 26, 2019, thanked Labij for his explanations, and stated that “it helps tremendously in my understanding of how these markets work. I was able to build a

workaround to the portal access issue and fetch both the day-ahead LMP data and the 5-minute RTBM LMP data.” TX-149.

41) Storms’ Source Code was completed by May 7, 2019. Tr. 67:19-68:21; Tr. 74:18-77:17. Neither party disputes that Storms’ Source Code, including the whiteboard depictions, was never provided to Defendants. Tr. 115:18-22; Tr. 565:3-6; *see also* Tr. 418:21-419:3.

42) Both parties offered expert testimony related to the functionality and operation of Storms’ Source Code. Plaintiffs’ expert, Dr. McClellan, analyzed Storms’ Source Code and concluded that, while never shown to Defendants, it corroborates that Storms conceived of each claim of the ’433 patent. Tr. 281:8-307:8. Defendants’ expert, Baer, analyzed Storms’ Source Code and concluded that “the BearBox source code does not support the conception of the claims of the ’433 patent.” Tr. 642:13-18. Based on the experts’ respective testimony and expert reports, the Court finds Baer’s testimony related to the functionality and operation of Storms’ Source Code to be more credible than Dr. McClellan’s.

43) Baer testified that Storms’ Source Code falls into three categories: (1) a user interface that would provide some manual control of a power distribution unit (PDU); (2) retrieving publicly available Bitcoin and power pricing data; and (3) simulations comparing profitability of mining Bitcoin versus selling power. Tr. 643:5-15.

44) The first category of Storms’ source code is dated after May 3, 2019. Tr. 645:1-9. Baer testified that this category of Storms’ Source Code allows a user to manually control the PDU relays attached to Bitcoin miners but is in no way associated with the other two categories of Storms’ Source Code. Tr. 643:16-645:9. Storms acknowledged that this category of source code did not have anything to do with Storms’ Data File, *see infra* Section I.E.4.c. *See* Tr. 157:18-158:7. Based on Storms’ concession and Baer’s credible testimony, the Court finds as a matter of



fact that the first category of Storms' Source Code did not relate to the subject matter claimed in the '433 patent.

45) The second category of Storms' Source Code comprises the files "DA\_LMP\_import.py," "DA\_LMP\_import\_AEC.py," and "LMP\_csv\_import.py." *See* TX-20 at 25, 27; *see also* TX-49. Baer testified that this second category of Storms' Source Code retrieved publicly available information related to the price of Bitcoin and power. Tr. 645:10-646:24.

46) The third category of Storms' Source Code includes the files "denis\_logic.py" (*see* TX-22; TX-20 at 13-19), "denis\_logic\_newgen.py" (*see* TX-20 at 4-10), "test\_profit.py" (*see id.* at 29-32), "arb\_main\_AEC.py" (*see* TX-24), and "miner\_amort\_breakeven.py" (*see* TX-46). Baer credibly testified these source code files are simulations of the BearBox System that compare profitability of mining Bitcoin against selling power. *See, e.g.*, Tr. 647:2-4; Tr. 648:2-6, 655:15-656:2.

47) Baer further testified that the third category Storms' Source Code generally follows the same logic-steps: first, Storms' Source Code retrieves publicly available Bitcoin information; second, Storms' Source Code retrieves the day-ahead and real-time energy prices; third, Storms' Source Code calculates a breakeven mining cost; and fourth, Storms' Source Code compares the breakeven cost to the day-ahead and real-time energy prices. If either energy price is greater than or equal to the breakeven cost, Storms' Source Code sends signals to turn off all miners connected to the BearBox System. If energy price is less than the breakeven cost, Storms' Source Code sends signals to turn on all miners connected to the BearBox System. Tr. 647:5-653:23, 658:23-659:3; *see also* TX-22. Baer conceded that Storms' Diagram, *see infra* Section I.E.4.b, demonstrates the functionality of this category of Storms' Source Code. Tr. 671:10-672:1.

48) Baer also credibly testified that the third category of Storms' Source Code runs on a cycle, meaning that the simulation re-runs every five (5) minutes. Tr. 654:13-25. Re-running the simulation of Storms' BearBox System every five minutes is a fixed value within Storms' Source Code, is not received, and is not associated with an amount of power. Tr. 655:1-11; Tr. 666:10-19.

49) Further, Baer credibly testified that the only concept of power usage in Storms' Source Code is the value "kW\_load." Tr. 660:3-662:16. However, Baer explained, and Storms agreed, *see* Tr. 146:23-147:6, that the "kW\_load" value is a single, hard-coded value, meaning the only way to modify that value is to physically change the code—such as through the code's interpreter. Tr. 660:3-661:16, 665:12-666:9; *see also* Tr. 661:17-662:16. The "kW\_load" value is not received by the BearBox System or Storms' Source Code, and both Baer and Dr. McClellan testified that the "kW\_load" value is an estimate of the amount of power that the BearBox System uses, which includes a 5% "fudge factor," i.e., an overestimate of the amount of power the BearBox System uses. Tr. 665:12-666:9; *see also* Tr. 282:19-283:9, 294:22-295:6, 297:14-22; TX-24 at 1; Tr. 420:12-18, 424:5-11.

50) Baer also credibly testified that the files in the third category of Storms' Source Code are all substantially similar. Tr. 656:3-9. For example, the only differences between "denis\_logic.py" and "arb\_main\_AEC.py" are different values for some variables, such as the hard-coded "kW\_load" value, minor differences in how data is written to a spreadsheet similar to Storms' Data File, *see infra* Section I.E.4.c, and other minor differences that do not impact the logic or functionality. Tr. 656:10-658:22. Other files in this category, such as "test\_profit.py," do not include all of the logic steps in "denis\_logic.py." Tr. 658:23-659:18. None of the files that analyze whether to turn miners on or off by comparing the breakeven price of Bitcoin to the real-



time and day-ahead energy prices pre-date the “denis logic” files. *See, e.g.*, TX-20 at 1; TX-24 at 5; TX-46 at 5.

## 2. Lancium – Pre-FCAT Mining Summit

51) Lancium was formed in November 2017 with the intention of co-locating flexible data centers, such as Bitcoin miners, at windfarms to exploit the highly variable power output of windfarms. *See, e.g.*, Tr. 436:12-14; Tr. 437:11-438:16; Tr. 533:4-5; *see also* TX-373; TX-374 at 00025182; Tr. 541:21-542:15; TX-266 at 00020054. Lancium sought to “ramp down” its flexible datacenters to allow the wind farm to sell that power to the grid when energy prices were high, but when power prices were low, Lancium would “ramp up” its flexible datacenters. Tr. 438:10-439:16; TX-266 at 00020049; TX-374 at 00025182; Tr. 533:22-534:16; TX-372 at 00025166; Tr. 539:9-540:21, 541:5-20. Lancium’s co-location was “behind-the-meter,” and Lancium would agree to curtail its power usage based on real-time signals so that the windfarm could capture times when the price of power was high (“Lancium’s Proposal”). Tr. 546:13-22.

52) By at least October 2018, Lancium performed analyses of how much more value windfarms would receive under Lancium’s Proposal, *see, e.g.*, Tr. 546:17-547:2, 551:24-552:17; TX-176, including an analysis for GlidePath in November 2018. *See* TX-233; TX-234 at 00018300; TX-795; *see also* Tr. 547:15-548:1, Tr. 548:10-549:17; TX-478.

53) Around May 2018, Lancium became a market participant in ERCOT to enable Lancium to obtain data, such as power price data, that could allow it to make contemporaneous decisions on its energy usage. Tr. 544:6-545:7; *see also* TX-711; TX-712.

54) Lancium filed WO Patent Application No. 2019/139632 (“the ’632 Application”), titled “Method and System for Dynamic Power Delivery to a Flexible Datacenter Using Unutilized Energy Sources,” which names both McNamara and Cline as inventors and has a priority date of

January 2018. TX-163 at Cover. Figure 6 of the '632 Application depicts the flexible data center (200) connected to the wind farm, as well as connections to the local power substation (690) and the grid (660). Tr. 441:13-442:7; TX-163 at Fig. 6; *see also* TX-163 at ¶¶ 53-54. Figure 2 of the '632 Application shows individual computing systems (100) of the flexible datacenter organized into racks and subsets (240), as well as a datacenter control system (220), which may be a computing system configured to “dynamically modulate power delivery to one or more computing systems (100).” Tr. 442:8-443:8; TX-163 at Fig. 2, ¶¶ 22, 30, 33, 38.

55) The '632 Application also describes that the flexible datacenter—based on an operational directive or via a determination based on monitored conditions, including economic conditions—would control its computing systems on a granular level, i.e., control on the individual computing system or collections of computing system level, to ensure that its systems consumed less power than the windfarm would generate. TX-163 at ¶¶ 22, 33, 44; Tr. 444:16-445:19. Thus, the flexible datacenter would monitor directives from the wind farm (and potentially the grid operator) indicating how much power the flexible datacenter could consume. TX-163 at ¶¶ 68, 90, Fig. 9; Tr. 445:2-446:10.

56) Cline credibly testified that, by the time the '632 Application was filed, Lancium monitored various conditions including receiving information on forecasts affecting the price of power and “economic considerations,” such as the real-time price of power, the price of Bitcoin, and other information enabling Lancium to determine whether it was profitable to mine. Tr. 446:11-448:6; *see also* Tr. 542:16-544:5; TX-594 at 00033410; *see also* TX-163 at Figs. 4, 9, ¶¶ 42, 44, 68-72.

57) No later than October 2018, Lancium was operating one-hundred and twenty (120) cryptocurrency miners at its Thomas Road R&D Facility in Houston, Texas. Tr. 448:24-450:21;



TX-462, TX-463 at 00027993. To control its miners, Lancium modified off-the-shelf software from software companies ServiceNow and Tier44. Tr. 451:9-452:9. At its Thomas Road R&D Facility, Lancium's system was monitoring some of the information disclosed in the '632 Application, including power and Bitcoin price, to determine a performance strategy based on whether it was profitable to mine Bitcoin. Tr. 467:24-468:4. Based on such information and the information now available based on its status with ERCOT—including the network and global hashrate—, Lancium calculated the “breakeven price” for different types of miners, *see, e.g.*, Tr. 469:13-470:11; TX-222; TX-223, and used this calculation to determine when to turn miners on or off. *See, e.g.*, Tr. 470:12-471:1, 472:6-473:4, 477:18-20, 478:12-479:2 (citing TX-345 at 00024902). Calpine Energy Solutions (“Calpine”) provided electricity for Lancium's Thomas Road R&D Facility, *see* Tr. 570:5-21, and Lancium maintained a “first power agreement” with Calpine until August 2019, meaning that Lancium paid the current market price for whatever power Lancium consumed. Tr. 574:7-12.

58) Lancium demonstrated its live system, including its 120 cryptocurrency miners, for an investor in September 2018. Tr. 459:16-461:14; TX-189 at 00015148-49; Tr. 464:14-465:4; TX-176 at 00014628-29; Tr. 465:5-468:4; TX-179; TX-180. At this time, Lancium also contemplated its system monitoring LMP, ERCOT parameters, and weather conditions, *see, e.g.*, Tr. 471:2-472:5; TX-222; TX-223, and controlling its systems remotely from its Network Operating Center, *see, e.g.*, Tr. 463:24-464:13; TX-176 at 00014629, or via a mobile computing device, *see, e.g.*, TX-163 at ¶¶ 29-30; TX-189 at 00015148-149.

59) On January 11, 2019, Lancium filed United States Patent Application No. 16/245,532 (“the '532 Application”) titled “Redundant Flexible Data Workload Scheduling.” TX-

165 at 00003135. The '532 Application lists McNamara and Cline as inventors. *Id.* at 00003137.

Among other disclosures, the '532 Application disclosed:

Some embodiments may involve identifying that a particular computational operation is a high priority operation. For instance, the enterprise funding the computational operation may emphasize the high priority status of the computational operation. In addition, the deadline for completing the computational operation may signal that the computational operation is high priority. As a result, a control system or another computing system may assign the high priority computational operation to multiple flexible datacenters. The assignment may specify for one or more flexible datacenters to initially support the computational operation and for one or more flexible datacenters to serve as a back-up in case of failure of the flexible datacenter(s) currently supporting the computational operation. The assignment of the computational operation may be based on power conditions and computational availability at the various flexible datacenters.

See TX-165 at ¶ 53.

60) Beginning in 2019, Lancium began to internally develop software as a primary platform for controlling its cryptocurrency miners. Tr. 477:18-478:11, 479:3-480:21; Tr. 481:12-482:16; TX-345 at 00024901. Around April 2019, Lancium investigated using an application program or interface to automatically retrieve LMP data directly from ERCOT. Tr. 480:22-481:11; TX-501. Cline credibly testified that, by May 1, 2019, Lancium's software was monitoring signals from a wind farm, ERCOT, Bitcoin price, real-time power price, hashrate, block height, and from the miners themselves—including the miners' actual power usage. Tr. 482:17-484:6; TX-320 at 00024330-32. Using that information, Lancium's software could determine a target power level that the miners should operate at and then send instructions to some or all of the miners to suspend or restart their hashing algorithms. Tr. 482:17-484:6; TX-320 at 00024330-32. Lancium's software eventually became known as "Lancium Smart Response," *see, e.g.*, Tr. 484:7-17; TX-320 at 0024330-31, and would operate by receiving the "Load Limit Setpoint," i.e., the maximum amount of power Lancium could use, and then determining whether



to use all, some, or none of that available power based on multiple variables or conditions. Tr. 484:18-487:7; TX-320 at 00024331-332. Lancium's Smart Response Software would also adjust to changes in the Load Limited Setpoint within an associated compliance period. *See* TX-320 at 00024333-34, Fig. 4-1.

61) Between 2018 and 2019, while Lancium was developing the software that became Lancium Smart Response, Lancium also worked with various companies to design and manufacture portable mining containers. Tr. 454:20-455:17; TX-371 at 00025037; Tr. 455:18-456:24, 457:7-17; *see also* TX-979. As of May 1, 2019, Lancium was considering purchasing forty (40) foot, two megawatt boxes holding approximately 1,428 cryptocurrency miners that met industry safety and security standards from manufacturer JV Driver/Ready Engineering, all for an estimated cost of approximately \$230,000. Tr. 475:5-24; TX-781 at 00021534; Tr. 552:23-553:24.

62) By at least May 2, 2019, Lancium was considering whether it could apply its developed technology to grid applications when, at lunch with two cryptocurrency business developers—including Jamie McAvity—, McNamara learned that participating in demand response programs within ERCOT could effectively discount the price of power from the grid. Tr. 556:22-558:13, 559:3-15; *see also* TX-748.

### **3. FCAT Mining Summit**

63) On May 3, 2019, Storms attended the FCAT Mining Summit in Boston, Massachusetts to learn more about the cryptocurrency industry, what others in the industry were doing, and to meet potential customers for his BearBox containers. Tr. 77:18-78:18; Tr. 110:21-111:7; TX-52 at 2. Prior to attending the FCAT Mining Summit, Storms sent a text message to Hakes explaining that Storms was “going to poke around and figure out if anybody else is doing

what we're doing." Tr. 118:5-8. Storms testified that "what we're doing" referred to his work with Hakes and GlidePath. Tr. 118:9-11.

64) During the FCAT Mining Summit, McNamara continued his discussion with Jamie McAvity about demand response programs within ERCOT. Tr. 559:19-560:2.

65) Both parties agree that, immediately following the FCAT Mining Summit, Storms met McNamara at a cocktail reception. Tr. 79:3-5. Before May 3, 2019, Storms had no knowledge of Lancium, and had never met or heard of McNamara. Tr. 116:13-17. Following the cocktail reception, a group of approximately eight people, including Storms and McNamara, went to dinner. Tr. 113:10-13; Tr. 216:12-14. Jon Cohen, the Chief Financial Officer of Lancium at the time, also attended this dinner, *see* Tr. 82:22-24, as well as Jamie McAvity. Tr. 113:10-114:12; Tr. 560:3-14.

66) The dinner lasted approximately two hours. Tr. 115:16-17. Storms sat across the table from McNamara. Tr. 115:7-15, 116:18-19. There is no dispute that Storms never showed McNamara or Jon Cohen any documents or source code at dinner. Tr. 115:18-116:4. Storms testified that he, McNamara, and Jon Cohen discussed the BearBox System, to which McNamara and Jon Cohen showed interest. Tr. 84:12-23. McNamara admits that Storms discussed his BearBox container, and that McNamara showed interest in its specifications and price. Tr. 563:3-12. McNamara and Storms did not discuss demand response programs or ancillary services. Tr. 562:25-563:2. Based on these facts, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter claimed in the '433 patent to McNamara, or anyone else employed by Lancium, during the May 3, 2019, dinner.



67) At dinner, Storms had at least two glasses of wine. Tr. 115:3-6. Following dinner, McNamara and Storms exchanged phone numbers. Tr. 84:24-85:2. Storms and McNamara never met again, and Storms never met or spoke to Cline or any other employee at Lancium. Tr. 116:8-12, 145:6-7. Ultimately, Storms never worked with Lancium. Tr. 144:25-145:7.

#### 4. Storms' Email

68) On May 4, 2019, Storms contacted McNamara via text message. TX-742 at 00035256. The next day, Storms wrote: "I'll put some feelers out to some of my PM friends this week about what we talked about Fri night." *Id.* Neither party disputes that, at the time, Lancium was seeking product managers for their traditional computing business, and that Storms offered to contact possible product managers in his network. Tr. 92:5:12; Tr. 563:13-22.

69) On May 5, 2019, McNamara sent a text message to Storms stating: "I also think your boxes may have some benefits vs the ones we are doing with JB [sic] driver[.] Lots of stuff to collaborate on." TX-742 at 00035256. Storms responded: "Absolutely, I can send you specs on the boxes/PDUs/logic design – what's your email?" *Id.* McNamara then responded with his Lancium email address. *Id.*

70) On May 6, 2019, Storms sent a text message to Hakes, stating: "There are people doing what we're trying to do in ERCOT ISO in Texas. Met a few of big energy guys." TX-14 at 46; Tr. 118:13-20. A few minutes later, Storms sent Hakes a link to "Lancium.com," followed by a link to McNamara's LinkedIn profile. TX-14 at 46; Tr. 118:24-119:6. Minutes later, Storms sent another text message to Hakes, stating: "The guys at Lancium are doing what we are trying to do exactly, but they don't have a container builder or software team yet." TX-14 at 47; Tr. 119:7-14. Storms admits that he had no knowledge of what Lancium was doing with its software development. Tr. 121:14-25; TX-14 at 49.

71) Later that same day, Storms sent a text message to Hakes, stating: “And Michael McNamara wants me to bring some of my former product manager friends for his distributed computer service.” TX-14 at 47; Tr. 119:23-120:6. Storms then wrote: “Plus they want my logic for curtailing miners on the DA and Real-Time LMP,” and, “[a]ll over dinner Friday night and several bottles of wine, they told me they were looking into Digital Shovel.” TX-14 at 48; Tr. 120:7-14. Both parties agree that Digital Shovel is a cryptocurrency container manufacturer, *see* Tr. 120:15-17, and that Lancium was concerned with the electrical hardware of Digital Shovel’s containers and the potential liability stemming therefrom if Lancium were to purchase these containers. *See* Tr. 120:18-23; *see also* TX-14 at 48.

72) On May 8, 2019, McNamara sent a follow up text message to Storms, asking: “Storms, can you send me those box design specs please!” TX-742 at 00035257. Storms responded that he would later send over the specifications later that day, and then followed up with a text message to McNamara on May 9, 2019, stating: “Redoing one of the spec sheets for the newer Whatsminer models then emailing over to you.” *Id.* Storms and McNamara did not communicate via text message after May 9, 2019. *Id.* Neither party disputes that Storms did not communicate any information related to the subject matter of the ’433 patent through his text messages with McNamara. Tr. 126:20-22; Tr. 391:9-19. Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter claimed in the ’433 patent to McNamara, or anyone else employed by Lancium, through Storms’ text messages with McNamara.

73) On May 9, 2019, Storms sent a single email to McNamara (“Storms’ Email”). TX-157 at 1. The subject line of Storms’ Email reads: “BearBox 20’ product details and supporting documents.” *Id.* The body of Storms’ Email reads:



Hey Michael,

See attached for the 20' BearBox product details and some supporting docs. I've also attached some recent modeling data from one of the Exelon wind sites (based on publicly available marketplace data) – I can model for any pricing node you guys might be interested in reviewing.

Let me know if you have any questions!

Talk soon,

A

*Id.*

74) Attached to Storms' Email were the following documents: (1) a one-page BearBox Product Specification Sheet ("BearBox Spec Sheet"), *see* TX-171; (2) an annotated diagram of BearBox's Automatic Miner Management System ("Storms' Diagram"), *see* TX-171; (3) specification sheets on fans and other hardware components, *see* TX-172 – TX-174; and (4) a data file modeling a simulation of the BearBox system ("Storms' Data File"), *see* TX-175. Storms agreed that McNamara did not ask for specifications on Storms' PDUs or logic design through their text message correspondence. Tr. 125:1-4. Storms and McNamara did not communicate following Storms' Email. Tr. 115:23-116:4; Tr. 565:3-6; *see also* Tr. 418:21-419:3. Storms admitted that nothing from the specification sheets on fans and other hardware components, *see* TX-172 – TX-174, related to the subject matter of the '433 patent. Tr. 128:9-129:8. Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that the specification sheets on fans and other hardware components attached to Storms' Email communicated the subject matter claimed in the '433 patent.

#### **a. BearBox Spec Sheet**

75) The BearBox Spec Sheet includes information related to BearBox's physical and electrical components, software management—including cgminer watchdog, PDU/relay mapping,

and optional real-time breakeven monitoring—, states that BearBox’s containers could accommodate up to 272 Bitcoin miners, specifies different types of miners that could be used, and specifies that the maximum amount of power the BearBox container could accommodate was approximately 373kW. TX-171.

76) Storms admitted that the BearBox Spec Sheet does not indicate whether the BearBox System requires a certain amount of power to be used by the system, and similarly does not indicate that the system must use at least a specified amount of power for a specified period of time. Tr. 145:14-146:5. Storms also admitted that the BearBox Spec Sheet does not indicate that the BearBox System measured the actual amount of power the system used. Tr. 135:22-136:1.

**b. Storms’ Diagram**

77) Storms’ Diagram is titled “BearBox Automatic Miner Management System Version 1.0.” TX-171 at 2. Storms’ Diagram was not part of the BearBox Spec Sheet. Tr. 132:12-15.

78) Storms’ Diagram illustrates a system wherein a BearBox container is connected to the electrical grid, depicted by a lightning bolt stemming from an illustration of six wind turbines. The lightning bolt is connected to a pipe, which immediately has a T-coupling. Off one end of the T-coupling, the electricity generated from the wind turbines transmits to the BearBox container. From the other end of the T-coupling, i.e., horizontally, stems two dotted lines, one labeled “Hourly,” which is connected to a red bubble titled “Day-Ahead LMP for pricing node,” and the other labeled “5-minute,” which is connected to a red bubble titled “RTMB LMP for pricing node.” See TX-171 at 2.

79) The parties dispute whether these two dotted lines represent the ability for the BearBox System to sell power back to the grid. See D.I. 256 at 7; D.I. 258 at 10-11. Baer credibly



testified that the second category of Storms' Source Code—the “DA\_LMP\_import.py,” “DA\_LMP\_import\_AEC.py,” and “LMP\_csv\_import.py.” files—retrieved publicly available information related to the price of Bitcoin and power, *see* Tr. 645:10-646:24, which supports that the dotted lines represent retrieving price of power information. *See* FF ¶ 45. Further, based on the parties' respective testimony, the Court finds Dr. Ehsani's testimony, *see* Tr. 681:19-684:23, regarding how a person of ordinary skill in the art would interpret Storms' Diagram to be more credible than either Dr. McClellan's or Storms' testimony, *see* Tr. 96:5-97:7; Tr. 168:21-169:4; Tr. 312:25-313:16. Based on these finding, the Court finds as a matter of fact that the two dotted lines represent the transmission of energy pricing information from the Day-Ahead Market and the Real-Time Market, not the ability of the BearBox System to sell electricity to the Day-Ahead Market or the Real-Time Market.

80) Storms admitted that Storms' Diagram does not indicate whether the BearBox System requires a certain amount of power to be used by the system, and similarly does not indicate that the system must use at least a specified amount of power for a specified period of time. Tr. 145:14-146:5. Storms also admitted that Storms' Diagram does not indicate that the BearBox System measured the actual amount of power the system used. Tr. 135:22-136:1.

### **c. Storms' Data File**

81) Storms' Data File is a spreadsheet that represents a simulation of whether to mine Bitcoin or sell the power back to the grid. Tr. 140:13-16. The decision to mine or not mine was made by the load. Tr. 149:10-150:21.

82) Storms admitted that Storms' Data File does not indicate whether the BearBox System requires a certain amount of power to be used by the system, and similarly does not indicate that the system must use at least a specified amount of power for a specified period of time. Tr.

145:14-146:5. Storms also admitted that the information in columns A-B, D-E, G, and I-J is publicly available data. Tr. 137:4-24; TX-887 at 1.

83) Further, Storms admitted that, based on Storms' Data File, a person could not tell how much power a load consumed in each 5-minute interval "unless you know how it's calculated." Tr. 168:3-8. Storms also sent a similar spreadsheet to a separate individual, who then asked: "what do you factor into the 'breakeven\_mining\_cost'?" TX-919 at 909; TX-920; Tr. 151:10-17. Storms responded by sending portions of his source code. Tr. 151:23-152:2; TX-919 at 908.

### **5. After The FCAT Mining Summit**

84) The Court finds McNamara's testimony related to his receipt of Storms' Email credible. McNamara testified that, upon receipt of Storms' Email, he spent no more than three minutes reviewing the attachments. Tr. 567:9-23; TX-770. McNamara also credibly testified that he considered the price of the BearBox System to be too high compared to other container manufacturers Lancium solicited, *see* Tr. 565:11-22, but forwarded Storms' Email, including all of the attachments, to other Lancium executives, including Cline. TX-770. In forwarding Storms' Email to Cline, McNamara wrote that he considered the BearBox System to be "very expensive," but did not comment on any of the attachments. TX-770.

85) The Court also credits Cline's testimony that, upon receiving the forwarded Storms' Email, Cline reviewed the BearBox Spec Sheet and believed the BearBox System was expensive, small, and lacking industry safety features when compared to the box JV Driver was designing and manufacturing for Lancium. Tr. 488:17-491:5; *see also* FF ¶ 60. Cline also testified that he did not recall whether he opened Storms' Data File, *see* Tr. 518:4-12, but metadata shows that Cline did download Storms' Data File on May 9, 2019. TX-984.



86) McNamara and Cline both testified that they were not aware of any internal discussions within Lancium regarding Storms, Storms' Email, or its attachments, after May 9, 2019, until this lawsuit was filed. Tr. 491:22-25; Tr. 568:2-3. Plaintiffs failed to proffer any conflicting evidence. Tr. 393:20-23. Accordingly, the Court credits this testimony from McNamara and Cline.

87) Following the FCAT Mining Summit, McNamara continued his discussions with Jamie McAvity, *see* Tr. 569:3-10; TX-748 – TX-750. On May 10, 2019, Jon Cohen contacted Calpine, asking whether it had “any intro material on participating in EROT’s [sic] [Emergency Response Service] program? We think [our] load is well suited, but were curious as to what the process and requirements are.” Tr. 570:5-21; TX-626 at 00033800. Calpine then introduced Lancium to Jay Young—a consultant with expertise on ERCOT’s Demand Response programs—who, on May 18, 2019, forwarded a slide deck explaining the function of QSEs in ERCOT’s Demand Response Program. Tr. 570:21-571:24; *see also* TX-437; TX-438 at 00026309-311; Tr. 571:25-572:11; TX-740; TX-741. Through Jay Young, Lancium was introduced to MP2, which became Lancium’s QSE when Lancium qualified as a “load resource” with ERCOT. Tr. 572:11-573:18; TX-496; TX-497 at 00030580.

88) On August 5, 2019, Calpine responded to an inquiry from Lancium regarding a fixed price power agreement given “how close we are to all time historical lows” for the price of power. Tr. 573:21-574:21; TX-758; TX-122. Calpine projected that Lancium could reduce its power price by \$10 per MWh. Tr. 574:13-575:4; TX--763; TX764; *see also* Tr. 575:12-25. Based on this projection, on August 14, 2019, Lancium entered into a fixed price power addendum with Calpine. Tr. 576:1-3; TX-756; TX-757. Section 4.2.2 of this 2019 addendum contained a standard, non-negotiated sell-back provision, *see* Tr. 576:8-17; TX-757, which is the same

provision contained in Lancium's 2018 "first power agreement," *see* Tr. 576:18-577:6; TX-122 at 00035638; *see also* FF at ¶ 57.

89) McNamara testified that Lancium had not appreciated its ability to sell-back power until it entered into the 2019 fixed price power addendum with Calpine because Lancium was not pre-purchasing power and, thus, could not sell it back. *See, e.g.*, Tr. 577:7-13; Tr. 566:20-25, 577:10-15, 578:2-5, 578:23-579:5; *see also* FF at ¶ 57. On August 16, 2019, McNamara emailed Cline, explaining that Lancium had just entered into a fixed price power agreement with Calpine, and further stating: "This is cool. We now have two revenue sources: Bitcoin mining and selling power back to the grid." TX-567. The Court finds McNamara's testimony related to how Lancium learned of its ability to sell-back power credible and, thus, relies on it.

90) On August 26, 2019, Lancium received an "award" under ERCOT's Load Resource Ancillary Services Program, which specifies an "award" in megawatts for each 1-hour interval in a 24-hour period. TX-981; TX-982; Tr. 492:15-494:5. Cline credibly testified that, upon receiving this "award," he realized that "the award is essentially an obligation on [Lancium's] part, that we consume that amount of power that ERCOT COULD curtail." TX-526; Tr. 494:17-496:14.

91) Cline credibly testified that this led to his understanding that Lancium was obligated to consume the awarded power so that ERCOT could exercise its option to curtail Lancium's power consumption. Tr. 496:8-25; TX-526; TX-310. Cline also credibly testified that this led Lancium to develop strategies to ensure that its system used at least the awarded amount of power. Tr. 497:1-499:5; TX-526; TX-310; *see also* TX-595. By October 2019, Lancium was investigating its ability to qualify as a CLR, rather than simply a load resource, based on Lancium's Smart Response Software, and in June 2020, Lancium became the first load-only CLR within ERCOT. *See* TX-298; Tr. 499:21-501:3.



92) On October 28, 2019, Lancium filed the '119 Application, which ultimately issued as the '433 patent. D.I. 239-1, Ex. 1 at ¶ 6; *see* '433 patent at Cover.

## **F. Conception of the Elements of the '433 Patent**

### **1. Independent Claims**

#### **a. Preamble [a], Elements [b] and [b1]**

93) The parties do not dispute that Storms' Email meets preamble [a] and elements [b] and [b1] of claim 1 of the '433 patent. *See* D.I. 256 at 5-6; D.I. 258 at 9-10. Additionally, the parties do not dispute that Storms' Email meets preamble [a] and elements [b] and [b1] of claims 17 and 20 of the '433 patent. *Id.*

94) However, Defendants dispute whether Storms' Email amounts to no more than a communication regarding what was already known in the art and, thus, cannot establish that Storms communicated preamble [a] and element [b] of claims 1, 17, and 20 of the '433 patent prior to Defendants' conception. D.I. 258 at 9. Specifically, Defendants assert that Lancium's '632 Application disclosed "flexible data centers consisting of a set of computing systems (computers) configured to perform computational operations (e.g., mining Bitcoin) using electrical power, including from the grid," prior to receiving Storms' Email. *Id.* Further, Defendants contend that, prior to receiving Storms' Email, Lancium's Thomas Road R&D Facility had already reduced to practice a system that was grid connected and using computer systems to mine Bitcoin. *Id.*

95) The Court finds as a matter of fact that Defendants had independently conceived of, and reduced to practice, preamble [a] and element [b] of claims 1, 17, and 20 of the '433 patent no later than January 2018. *See* FF at ¶¶ 51-62. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms

communicated preamble [a] and element [b] of claims 1, 17, and 20 of the '433 patent prior to Defendants' conception.

96) Additionally, the parties dispute whether Storms' Email corroborates communication of element [b1] of the '433 patent prior to Lancium's independent conception. D.I. 256 at 17-18; D.I. 258 at 17. In other words, did Lancium conceive of element [b1] prior to receiving Storms' Email on May 9, 2019.

97) The Court finds as a matter of fact that Lancium independently conceived of element [b1] of the '433 patent prior to Storms' Email for three reasons. First, by at least January 2018, Lancium's system was monitoring conditions, including economic conditions, to control its computing systems on a granular level—as disclosed in the '632 Application. *See* FF at ¶¶ 54-55. Second, Cline credibly testified that, by the time the '632 Application was filed, Lancium monitored various conditions including receiving information on forecasts affecting the price of power and “economic considerations,” such as the real-time price of power, the price of Bitcoin, and other information. *See* FF at ¶ 56. Third, Cline credibly testified that, by no later than October 2018, Lancium's system at its Thomas Road R&D Facility was monitoring conditions including power price, Bitcoin price, network and global hashrate, LMP, ERCOT parameters, and weather conditions to determine a performance strategy based on whether it was profitable to mine Bitcoin. *See* FF at ¶¶ 57-58.

98) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated element [b1] of the '433 patent prior to Defendants' independent conception.



**b. Element [b2]**

99) The parties dispute whether Storms' Diagram, the BearBox Spec Sheet, or Storms' Data File meets element [b2] of claim 1 of the '433 patent. D.I. 256 at 7-10; D.I. 258 at 10-12. The Court has previously construed "power option agreement" to mean "an agreement between a power entity associated with the delivery of power to a load and the load, wherein the load provides the power entity with the option to reduce the amount of power delivered to the load up to an agreed amount of power during an agreed upon time interval such that the load must use at least the amount of power subject to the option during the time interval unless the power entity exercises the option." *See* D.I. 219.

100) Plaintiffs contend that the lightning bolt between the six wind turbines and the pipe connected to the BearBox container, as depicted in Storms' Diagram, *see* TX-171 at 2, meets element [b2] of claim 1 of the '433 patent. Specifically, Plaintiffs argue Storms' Diagram meets element [b2] because "[t]he contractual arrangement between the load and the generator could vary, but the presence of the connection between the two implies that they have agreed on a contractual arrangement defining how power would be delivered, at what price, and the like." D.I. 256 at 7-8. Based on Storms' Diagram, Plaintiffs conclude that "the windfarm has the option of selling to the grid or providing power to the load to consumer for Bitcoin mining." D.I. 256 at 7. Neither party disputes that the six wind turbines are "a power entity associated with the delivery of power," and that the BearBox container is "a load."

101) The Court finds as a matter of fact that Storms' Diagram does not meet element [b2] of claim 1 of the '433 patent for three reasons. First, the Court has already found as a factual matter that the two dotted lines represent the transmission of energy pricing information from the Day-Ahead Market and the Real-Time Market, not the ability of the power entity to sell electricity

to the Day-Ahead Market or the Real-Time Market. *See* FF at ¶ 79. Second, there is no indication that a power option agreement, as construed by the Court, exists between the power entity and the load. In fact, Storms admitted that Storms' Diagram (i) does not indicate whether the BearBox System requires a certain amount of power to be used by the system, (ii) does not indicate that the BearBox System must use at least a specified amount of power for a specified period of time, and (iii) does not indicate that the BearBox System measured the actual amount of power the system used. *See* FF at ¶ 80. Third, the Court finds that Dr. McClellan's testimony related to the BearBox System operating under a power option agreement, or that a person of ordinary skill in the art would have understood this relationship, was not credible based on multiple inconsistencies between Dr. McClellan's expert reports, deposition testimony, and trial testimony. *See, e.g.*, Tr. 266:18-267:4; D.I. 247 at 3; Tr. 334:3-5; Tr. 398:13-401:23, 403:10-404:9, 404:15-406:19, 408:11-414:25.

102) The parties also dispute whether the BearBox Spec Sheet meets element [b2] of claim 1 of the '433 patent. Plaintiffs contend that the BearBox Spec Sheet corroborates that Storms conceived of the BearBox System that was connected to a power generation facility, that the BearBox System had ability of the system to mine Bitcoin or not mine Bitcoin, and that the BearBox System could mine Bitcoin at a particular target. *See* D.I. 257 at ¶ 30 (citing Tr. 312:3-7; Tr. 322:4-327:14; TX-157).

103) The Court finds as a matter of fact that the BearBox Spec Sheet does not meet element [b2] of claim 1 of the '433 patent for two reasons. First, the BearBox Spec Sheet only discloses information related to the BearBox System's physical hardware components and software management. *See* FF at ¶ 75. Second, the BearBox Spec Sheet has no indication that a power option agreement, as construed by the Court, exists between the power entity and the load.



In fact, Storms admitted that the BearBox Spec Sheet (i) does not indicate whether the BearBox System requires a certain amount of power to be used by the system, (ii) does not indicate that the BearBox System must use at least a specified amount of power for a specified period of time, and (iii) does not indicate that the BearBox System measured the actual amount of power the system used. *See* FF at ¶ 76.

104) Additionally, the parties also dispute whether Storms' Data File meets element [b2] of claim 1 of the '433 patent. The Court has previously construed "minimum power threshold" to mean "a minimum amount of power a load must use during an associated time interval." *See* D.I. 219. Plaintiffs contend that Storms' Data File corroborates conception of element [b2] because it shows 5-minute intervals over which the BearBox System functions, describes the mining revenue indicating power utilization at about 31 kW during an associated 5-minute interval, and describes the sell-back revenue indicating a reduction in power usage in the full amount for that 5-minute interval. *See* D.I. 257 at ¶ 26 (citing Tr. 309:12-13, 311:17-21, 313:21-22, 316:10-15, 317:4-8, 323:10-324:24; TX-157). Furthermore, Plaintiffs contend that Storms' Data File is an illustration of the functionality of Storms' Source Code, which corroborates Storms' conception of element [b2] of claim 1 of the '433 patent. *See* D.I. 257 at ¶¶ 27, 32.

105) The Court finds as a matter of fact that Storms' Data File does not meet element [b2] of claim 1 of the '433 patent for four reasons. First, there is no indication that a power option agreement, as construed by the Court, exists between the power entity and the load. In fact, Storms admitted that the Storms' Data File does not indicate whether the BearBox System requires a certain amount of power to be used by the system and does not indicate that the BearBox System must use at least a specified amount of power for a specified period of time. *See* FF at ¶ 82. Second, Baer credibly testified that the 5-minute interval in Storms' Source Code functions to "re-

run” the simulation every 5 minutes, but that value is fixed within the code, is not received, and is not associated with an amount of power. *See* FF at ¶ 48. Third, the “kW\_load” value in Storms’ Source Code does not represent the required amount of power that a load must use, i.e., a “minimum power threshold,” but rather represents an estimation of the power usage of the miners with a 5% “fudge factor.” *See* FF at ¶ 49. Fourth, Storms conceded that Storms’ Data File was not concerned with maintaining the load above a certain power level because the intent of the BearBox System was that the load would run at 100% if it was profitable to mine and 0% if it was more profitable to sell power back. Tr. 148:25-149:5; *see also* Tr. 149:6-9.

106) Based on these findings, the Court finds as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms conceived of element [b2] of claim 1 of the ’433 patent.

### **c. Element [b3]**

107) The parties dispute whether Storms’ Email, specifically Storms’ Data File, meets element [b3] of claim 1 of the ’433 patent. *See* D.I. 256 at 11-12; D.I. 258 at 12-13.

108) Plaintiffs contend that Storms’ Data File meets element [b3] of claim 1 of the ’433 patent because it “describes the operation of Storms’ source code, showing for each of eight-hundred twenty-five (825) 5-minute intervals, that the system monitored conditions, determined a performance strategy using breakeven and revenue generation calculations, and instructed miners to utilize energy to mine or instructed the miners to stop mining when curtailment was required.” D.I. 256 at 11 (citing D.I. 257 at ¶ 32). In other words, Plaintiffs assert that Storms’ Data File corroborates that Storms conceived of a system that would continuously mine Bitcoin except for the limited instances when the miners were instructed to stop consuming power, which was determined for every 5-minute interval. *Id.* Further, Plaintiffs argue that Storms’ Diagram also



shows these alternating periods of mining (shown with Bitcoin symbols) and curtailment/sellback activities (shown with dollar signs). D.I. 256 at 11-12; *see* TX-171 at 2.

109) The Court finds as a matter of fact that neither Storms' Data File or Storms' Diagram meet element [b3] of claim 1 of the '433 patent for six reasons. First, Plaintiffs' reliance on Storms' Data File as corroborating the functionality of Storms' Source Code is belied by the fact that Plaintiffs' own expert, Dr. McClellan, testified that Storms' Data File provides "information upon which to embark on a reverse engineering exercise of what Mr. Storms' system did," *see* Tr. 374:21-375:12, but that such a reverse engineering exercise "would be fraught with trial and error," *see* Tr. 397:11-16. Second, Storms admitted that, based on Storms' Data File, a person could not tell how much power a load consumed in each 5-minute interval "unless you know how it's calculated." *See* FF at ¶ 83; Tr. 168:3-8. However, there is no dispute that Storms' Source Code was never provided to Defendants. *See* FF at ¶ 41. Third, Baer credibly testified that the 5-minute interval in Storms' Source Code functions to "re-run" the simulation every 5 minutes, but that value is fixed within the code, is not received, and is not associated with an amount of power. *See* FF at ¶ 48. Fourth, Storms' Data File does not demonstrate that, responsive to receiving power option data, the BearBox System determines a power consumption target that is equal or greater than the minimum power threshold associated with each time interval because, as a matter of fact, Storms' Data File simulated whether to mine or not mine based on a comparison of the price of power versus the price of Bitcoin. *See* FF at ¶¶ 46-47. And, while Baer testified that Storms' Diagram illustrated the functionality of Storms' Source Code, *see* Tr. 671:10-672:1, there is no evidence establishing that Storms' Diagram determines a power consumption target that is equal or greater than the minimum power threshold associated with each time interval. In fact, Storms admitted that Storms' Diagram does not indicate that the BearBox System must use

at least a specified amount of power for a specified period of time. *See* FF at ¶ 80. Fifth, any assertion that Storms' Data File corroborates that the BearBox System determined a power consumption target that is equal to or greater than the minimum power threshold associated with each time interval is belied by Storms' admission that the "kW\_load" value is hard-coded, meaning the only way to modify that value is to physically change the code. Tr. 146:23-147:6; *see also* Tr. 665:12-666:9; *see* FF at ¶ 49. In fact, the "kW\_load" value is not received by the BearBox System or Storms' Source Code. *See* FF at ¶ 49. Sixth, Storms conceded that Storms' Data File was not concerned with maintaining the load above a certain power level because the intent of the BearBox System was that the load would run at 100% if it was profitable to mine and 0% if it was more profitable to sell power back, *see* Tr. 148:25-149:5; *see also* Tr. 149:6-9, which belies any assertion that the BearBox System could determine a power consumption target equal to or greater than the minimum power threshold.

110) Accordingly, the Court finds as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms conceived of element [b3] of claim 1 of the '433 patent.

#### **d. Element [b4]**

111) The parties dispute whether Storms' Diagram, the BearBox Spec Sheet, or Storms' Data File meets element [b4] of claim 1 of the '433 patent. *See* D.I. 256 at 12; D.I. 258 at 13; *see also* D.I. 257 at ¶¶ 36-37.

112) Plaintiffs contend that Storms' Diagram, the BearBox Spec Sheet, and Storms' Data File all corroborate that Storms conceived of element [b4] of claim 1 of the '433 patent because each describe "control systems' remotely controllable PDU, which enabled fine-grain load control of the systems 272 miners of varying types." D.I. 256 at 12 (citing D.I. 257 at ¶ 37). In one example, Plaintiffs assert that "each miner consumed about 1.3 kW per hour, for a maximum



amount of power consumption of about 373kw per hour, or about 31 kW per 5-minute interval (about .1 kW per miner).” *Id.* Plaintiffs further aver that Storms’ Data File describes “the 5-minute intervals over which the system functions, describing mining revenue indicating power utilization at about 31 kW during an associated 5-minute interval and the sell-back revenue indicating a reduction in power usage in the full amount for that 5-minute interval.” D.I. 257 at ¶ 37 (citing Tr. 309:12-13; Tr. 311:17-21; Tr. 313:21-22; Tr. 316:10-15; Tr. 317:4-8; Tr. 323:10-324:24).

113) The Court finds as a matter of fact that Storms’ Email does not meet element [b4] of claim 1 of the ’433 patent for two reasons. First, while both the BearBox Spec Sheet and Storms’ Diagram describe the BearBox System as capable of custom remote control of the PDUs, Plaintiffs did not otherwise proffer evidence establishing that the BearBox System could individually control the system of 272 miners. TX-171. In fact, as Baer credibly testified, the first category of Storms’ Source Code allows users to manually control the PDU relays attached to Bitcoin miners, but there is no indication that the BearBox System could remotely control individual miners. Tr. 643:16-645:9; *see* FF at ¶ 44. Rather, Storms’ Source Code “only ever instructs . . . all the relays of the PDUs to turn on or off.” *See* Tr. 662:18-664:10. Although Dr. McClellan testified that Storms’ Source Code had the functionality to turn individual miners on or off, *see* Tr. 280:10-281:2, 295:4-296:2, the Court finds Baer’s testimony more credible and, thus, does not rely on Dr. McClellan’s testimony. Second, even if Storms’ Email did meet element [b4] of claim 1 of the ’433 patent, the Court finds as a matter of fact that Storms did not communicate element [b4] prior to Defendants’ independent conception. As disclosed in the ’632 Application filed in January 2018, Defendants had conceived of a system where a set of computer systems issued instructions to perform computational operations based on a performance strategy derived

from monitored conditions, *see* FF at ¶¶ 54-56, and reduced the system to practice by October 2018. *See* FF at ¶¶ 57-58.

114) Accordingly, the Court finds as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms conceived of element [b4] of claim 1 of the '433 patent.

### **1. Dependent Claims**

#### **a. Claims 2, 3, and 5**

115) The parties dispute whether Storms' Email corroborates that Storms conceived of and communicated the subject matter of dependent claims 2, 3, and 5 of the '433 patent to Defendants prior to Defendants' independent conception. *See* D.I. 256 at 12-13; D.I. 258 at 13-14. Specifically, Plaintiffs assert that "[a]s explained above with respect to claim 1, Storms' system monitored real-time and day-ahead power prices and various parameters associated with Bitcoin mining computational operations[.]" which is corroborated by Storms' Diagram, Storms' Data File, and Storms' Source Code. D.I. 256 at 12-13.

116) Claim 2 depends from claim 1 and adds specific monitored conditions, i.e., the "price of power from the power grid" and "a plurality of parameters associated with one of more computational operations . . ." *See* '433 patent at claim 2. Claim 3 and claim 5 depend from claim 1, and further limit the control systems' determination of a performance strategy. *See, e.g.*, '433 patent at claim 3, 5.

117) The Court finds as a matter of fact that Storms' Email does meet claim 2 of the '433 patent because Plaintiffs have established by clear and convincing evidence that Storms did conceive of a system that monitored the price of power from the power grid and a plurality of parameters associated with one or more computational operations. Both Storms' Diagram and the second category of Storms' Source Code corroborate that Storms conceived of the BearBox



System as monitoring both the price of power and other various parameters associated with one or more computational operations. *See* FF at ¶¶ 45-47, 79; TX-171 at 2; *see also* Tr. 349:17-354:19. The Court also finds as a matter of fact that Storms communicated the concept of claim 2 of the '433 patent to Defendants on May 9, 2019, when Storms emailed Storms' Data File and Storms' Diagram to McNamara. *See* FF at ¶¶ 73-74. However, the Court also finds as a matter of fact that Storms did not communicate the concept of claim 2 of the '433 patent to Defendants prior to Defendants' independent conception. By at least January 2018, Lancium's system was monitoring conditions, including economic conditions, to control its computing systems on a granular level—as disclosed in the '632 Application. *See* FF at ¶¶ 54-56. And, by no later than October 2018, Lancium's system at its Thomas Road R&D Facility was monitoring conditions including power price, Bitcoin price, network and global hashrate, LMP, ERCOT parameters, and weather conditions to determine a performance strategy based on the profitability of mining Bitcoin. *See* FF at ¶¶ 57-58.

118) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter of claim 2 of the '433 patent prior to Defendants' independent conception. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms' Email significantly contributed to claim 2 of the '433 patent because Defendants had independently conceived of the subject matter more than one year before receiving Storms' Email. *See* FF at ¶¶ 54-56.

119) The Court finds as a matter of fact that Storms' Email does not meet claim 3 of the '433 patent because the Court has already found as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms conceived of a system configured to receive

power option data based, at least in part, on a power option agreement, which specifies a set of minimum power thresholds and associated time intervals, i.e., element [b2] of claim 1 of the '433 patent. *See* FF at ¶ 106.

120) The Court also finds as a matter of fact that Storms' Email does not meet claim 5 of the '433 patent for the same reasons the Court found as a matter of fact that Storms' Email does not meet element [b3] of claim 1 of the '433 patent. *See* FF at ¶ 109.

121) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of the subject matter of claim 3 or claim 5 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 3 or claim 5 of the '433 patent.

#### **b. Claim 4**

122) The parties dispute whether Storms' Email corroborates that Storms conceived of and communicated the subject matter of dependent claim 4 of the '433 patent to Defendants prior to Defendants' independent conception. D.I. 256 at 12-13; D.I. 258 at 13-14; *see also* D.I. 257 at ¶ 39.

123) Claim 4 of the '433 patent depends from claim 1, and recites:

4. The system of claim 3, wherein the performance strategy further comprises:

an order for the set of computing systems to follow when performing the one or more computational operations, wherein the order is based on respective priorities associated with the one or more computational operations.

*See* '433 patent at claim 4.



124) Plaintiffs assert that Storms' Data File, Storms' Diagram, and the BearBox Spec Sheet corroborate that Storms conceived of a system that "monitored and used this particular data in the manner recited in the claims." D.I. 257 at ¶ 39. Specifically, Plaintiffs' expert, Dr. McClellan, testified that Storms' Diagram and the BearBox Spec Sheet corroborate that the BearBox System "could individually instruct and remotely control PDU[s]," and "could individually instruct miners to turn on or off based on prioritization received from or imputed from Bitcoin mining – Bitcoin network data, power market data, and so on." Tr. 349:17-354:19. Dr. McClellan also testified that "[o]rdering of operations is a well known and conventional feature in computer operations," but that Storms' Data File also corroborates conception of this claim. Tr. 351:22-352:22.

125) The Court finds as a matter of fact that Storms' Email does not meet dependent claim 4 of the '433 patent for three reasons. First, the Court has already found as a matter of fact that, while both Storms' Spec Sheet and Storms' Diagram describe the BearBox System as capable of custom remote control over the PDUs, Plaintiffs did not otherwise proffer evidence establishing that the BearBox System could individually control the system of 272 miners. TX-171. The Court also found Baer's testimony that Storms' Source Code "only ever instructs . . . all the relays of the PDUs to turn on or off" to be more credible than Dr. McClellan's testimony. Tr. 643:16-645:9; *see* FF at ¶ 113. Second, the Court finds Cline's testimony that Lancium was considering "configurable algorithms" to permit its software to prioritize computing workloads by no later than April 11, 2018, credible. Tr. 452:10-453:13; *see also* TX-199; TX-200 at 00016282. Third, by at least January 11, 2019, Defendants had conceived of a system that performed computational operations based on respective priorities—as disclosed in the '532 Application. *See* TX-165 at ¶ 53; *see* FF at ¶ 59. Thus, even if Storms' Email did meet dependent claim 4 of the '433 patent, the

Court finds as a matter of fact that Defendants' independent conception of claim 4 of the '433 patent precedes Storms' Email.

126) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of the subject matter of claim 4 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 4 of the '433 patent.

**c. Claims 6-8, 13-14, and 19**

127) The parties dispute whether Storms' Email corroborates that Storms conceived of and communicated the subject matter of dependent claims 6-8, 13-14, and 19 of the '433 patent to Defendants prior to Defendants' independent conception. D.I. 256 at 13 (citing D.I. 257 at ¶ 40); D.I. 258 at 14.

128) Claims 6-8 depend from claim 1, and recite additional limitations related to power option data, minimum power thresholds, and power consumption targets, such that the system determines and implements a revised performance strategy. *See* '433 patent at claim 6, 7, 8. Claim 13 depends from claim 1, and recites that the second time interval associated with a minimum power threshold is subsequent to the first time interval associated with a minimum power threshold. *Id.* at claim 13. Claim 14 depends from claim 1, and adds that the performance strategy comprises a first power consumption target equal to or greater than the first minimum power threshold, and a second power consumption target equal to or greater than the second minimum power threshold. *Id.* at claim 14. Claim 19 depends from claim 17, and recites additional limitations related to power option data, minimum power thresholds, and reduced power



consumption targets, so that the system determines and implements a modified performance strategy. *Id.* at claim 19.

129) Plaintiffs rely on the same evidence offered to establish that Storms conceived of the subject matter of claim 1 of the '433 patent—including Storms' Data File, the BearBox Spec Sheet, Storms' Diagram, and Storms' Source Code—to support its contention that Storms conceived of a “system [that] used monitored conditions and power option data over multiple, consecutive intervals in the manner recited in the claims.” D.I. 256 at 13; *see also* D.I. 257 at ¶ 40 (citing Tr. 354:20-359:15; TX-24; TX-157; TX-46).

130) The Court finds as a matter of fact that Storms' Email does not meet the elements of dependent claims 6-8, 13-14, and 19 of the '433 patent. The Court has already found as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms communicated preamble [a] of claims 1, 17, and 20 or elements [b] and [b1] of claim 1 of the '433 patent prior to Defendants' independent conception. *See* FF at ¶¶ 95, 98. The Court has also found as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms conceived of elements [b2], [b3], or [b4] of claim 1 of the '433 patent. *See* FF at ¶¶ 106, 110, 114. Based on these findings, and because Plaintiffs rely on identical evidence proffered in support of conception of the elements of claim 1 of the '433 patent, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of the subject matter of claims 6-8, 13-14, and 19 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claims 6-8, 13-14, and 19 of the '433 patent.

#### d. Claims 9-12 and 18

131) The parties dispute whether Storms' Email corroborates that Storms conceived of and communicated the subject matter of dependent claims 9-12 and 18 of the '433 patent to Defendants prior to Defendants' independent conception. D.I. 256 at 13-14 (citing D.I. 257 at ¶ 41); D.I. 258 at 14.

132) Claims 9-12 depend from claim 1, while claim 18 depends from claim 17. *See* '433 patent at claim 9, 10, 11, 12, 18. Claim 9 recites that "the control system is a remote master control system positioned remotely from the set of computing systems." *Id.* at claim 9. Claim 10 recites that "the control system is a mobile computing device," *id.* at claim 10, while claim 11 adds that "the control system is configured to receive the power option data while monitoring the set of conditions." *Id.* at claim 11. Claim 12 recites that the control system is configured to request and receive power option data from a qualified scheduling entity ("QSE"). *Id.* at claim 12. Claim 18 adds that the performance strategy further comprises instructions so that the computing systems can operate at an increased frequency based on a combination of power option data and information about the set of computing systems. *Id.* at claim 18.

133) Plaintiffs assert that claims 9-12 and 18 add "conventional features well-known in the art, each of which was incorporated into Storms' [BearBox System] and communicated to Lancium" through Storms' Email. D.I. 256 at 13; *see also* D.I. 257 at ¶ 41. For example, Plaintiffs contend that Storms conceived of the subject matter of claim 9 of the '433 patent because Storms' Diagram and the BearBox Spec Sheet corroborate that the BearBox System could remotely control PDUs. *Id.*; Tr. 359:20-362:7. Similarly, Plaintiffs assert that the BearBox Spec Sheet demonstrates that the BearBox System ran on a mobile computing device, i.e., Storms' laptop, Tr. 362:8-23, which meets claim 10 of the '433 patent. D.I. 257 at ¶ 41. Claim 11 is purportedly met



because the BearBox Spec Sheet and Storms' Data File show that the BearBox System was retrieving conditions associated with the power markets and Bitcoin in 5-minute intervals. Tr. 362:24-365:5. Finally, Plaintiffs contend that the subject matter of claim 12 of the '433 patent was a "functionality that existed in ERCOT for 20 years." D.I. 257 at ¶ 41 (citing Tr. 365:6-18; Tr. 193:18-197:7).

134) The Court finds as a matter of fact that Storms' Email does meet claim 9 of the '433 patent because Plaintiffs have established by clear and convincing evidence that Storms did conceive of a system that could remotely control PDUs. Both Storms' Diagram and the BearBox Spec Sheet corroborate that Storms conceived of the BearBox System as being capable of remotely controlling the system's PDUs. Tr. 359:20-362:7; *see* TX-171 at 1-2. The Court also finds as a matter of fact that Storms communicated the concept of claim 9 of the '433 patent to Defendants on May 9, 2019, when Storms emailed Storms' Diagram and the BearBox Spec Sheet to McNamara. *See* FF at ¶¶ 73-74. However, the Court also finds as a matter of fact that Storms did not communicate the concept of claim 9 of the '433 patent to Defendants prior to Defendants' independent conception. By at least October 2018, Lancium's control system operated remotely from its flexible datacenters. Tr. 463:24-464:13; TX-176 at 00014629; *see also* FF at ¶¶ 57-58.

135) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter of claim 9 of the '433 patent prior to Defendants' independent conception. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms' Email significantly contributed to claim 9 of the '433 patent because Defendants had independently conceived of, and reduced to practice, the subject matter prior to receiving Storms' Email. *See* FF at ¶¶ 57-58.

136) The Court finds as a matter of fact that Storms' Email does meet claim 10 of the '433 patent because Plaintiffs have established by clear and convincing evidence that Storms did conceive of a control system that is a mobile computing device. Both Storms' Diagram and the BearBox Spec Sheet corroborate that Storms conceived of the BearBox System as operating via a mobile computing device, such as Storms' laptop. Tr. 362:8-23; *see* TX-171 at 1-2. The Court also finds as a matter of fact that Storms communicated the concept of claim 10 of the '433 patent to Defendants on May 9, 2019, when Storms emailed Storms' Diagram and the BearBox Spec Sheet to McNamara. *See* FF at ¶¶ 73-74. However, the Court also finds as a matter of fact that Storms did not communicate the concept of claim 10 of the '433 patent to Defendants prior to Defendants' independent conception. By at least January 2018, Lancium conceived of its control system operating via a mobile computing device. *See* TX-163 at ¶¶ 29-30; TX-189 at 00015148-149); *see also* FF at ¶ 58.

137) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the subject matter of claim 10 of the '433 patent prior to Defendants' independent conception. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms' Email significantly contributed to claim 10 of the '433 patent because Defendants had independently conceived of the subject matter prior to receiving Storms' Email. *See* FF at ¶ 58.

138) The Court finds as a matter of fact that Storms' Email does not meet dependent claim 11 of the '433 patent. The Court has already found as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms conceived of element [b2] of claim 1 of the '433 patent. *See* FF at ¶ 106. Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of the subject matter



of claim 11 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 11 of the '433 patent.

139) The Court finds as a matter of fact that Storms' Email does not meet dependent claim 12 of the '433 patent for three reasons. First, there is no dispute that Storms' Email, including Storms' Diagram and Storms' Data File, never refers to a QSE. TX-171; TX-175; Tr. 365:13-18. Second, there is no dispute that requesting and receiving power option data from a QSE was well-known and conventional within ERCOT for nearly two decades. *See, e.g.*, Tr. 365:6-18; Tr. 193:18-197:7. Third, Baer credibly testified that Storms' Source Code does not "provide a request to a qualified scheduling entity (QSE)," or receive power option data in response to such a request. Tr. 665:12-666:18. In fact, Storms' Source Code does not receive power option data because the "kW\_load" value is hard-coded, meaning the only way to modify that value is to physically change the code. *See* Tr. 665:12-666:9; *see also* FF at ¶ 49. Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of, or communicated, the subject matter of claim 12 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 12 of the '433 patent.

140) The Court finds as a matter of fact that Storms' Email does not meet dependent claim 18 of the '433 patent. Plaintiffs assert that Storms' Diagram corroborates that the BearBox System used "the cgminer software . . . [to] provide[] the ability to increase the frequency at which the miner's operate." D.I. 256 at 14; *see* TX-171. However, neither party disputes that cgminer software is open-source software that has been publicly available since 2015. *See, e.g.*, Tr. 371:21-

372:15; Tr. 668:21-669:12. Moreover, Defendants contend, and Plaintiffs do not dispute, that the cgminer software was not written by Storms and that it is not an instruction used in Storms' Source Code. Tr. 669:9-670:12. That the cgminer software was not written by Storms, or even incorporated into Storms' Source Code, belies Storms' assertion that the BearBox System could increase the frequency at which the miners operate. Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of the subject matter of claim 18 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 18 of the '433 patent.

**e. Claim 16**

141) The parties dispute whether Storms' Email—specifically, Storms' Data File—corroborates that Storms conceived of and communicated the subject matter of dependent claim 16 of the '433 patent to Defendants prior to Defendants' independent conception. D.I. 256 at 14 (citing D.I. 257 at ¶ 42); D.I. 258 at 14-15.

142) Claim 16 depends from claim 1 and reads:

16. The system of claim 1, wherein the set of conditions monitored by the control system further comprise:

a price of power from the power grid; and

a global mining hash rate and a price for a cryptocurrency; and

wherein the control system is configured to:

determine the performance strategy for the set of computing systems based on a combination of at the portion of the power option data, the price of power from the power grid, the global mining hash rate and the price for the cryptocurrency,

wherein the performance strategy specifies for at least a subset of the set of computing systems to perform mining operations for the



cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

*See* '433 patent at claim 16.

143) Plaintiffs assert that Storms' Data File corroborates Storms' conception of a system that "compared mining profitability and instructed miners to mine Bitcoin when mining revenue was greater than the price of power from the power grid as recited in claim 16." D.I. 256 at 14 (citing D.I. 257 at ¶ 42). Specifically, Storms' Data File purportedly corroborates that the BearBox System "compared the revenue obtained by performing mining operations for Bitcoin," i.e., column H of Storms' Data File, "and mined Bitcoin in circumstances in which the price of power from the grid," i.e., column J of Storms' Data File, "was equal or less than the revenue obtainable from mining Bitcoin." *Id.* (citing D.I. 257 at ¶ 43); *see also* Tr. 309:12-13; Tr. 311:17-21, 313:21-22; Tr. 316:10-15, 317:4-8; Tr. 323:10-324:24.

144) The Court finds as a matter of fact that Storms' Email, including Storms' Data File, does not meet dependent claim 16 of the '433 patent for four reasons. First, the Court has already found as a matter of fact that, while both Storms' Spec Sheet and Storms' Diagram describe the BearBox System as capable of custom remote control over the PDUs, Plaintiffs did not otherwise proffer evidence establishing that the BearBox System could individually control the system of 272 miners. TX-171. The Court also found Baer's testimony that Storms' Source Code "only ever instructs . . . all the relays of the PDUs to turn on or off" to be more credible than Dr. McClellan's testimony. Tr. 643:16-645:9; *see* FF at ¶ 113. Second, the Court finds Baer's testimony that Storms' Source Code does not instruct miners to turn on, i.e., mine, when the price of power is equal to the mining revenue to be credible. *See* FF at ¶ 47. Baer testified that Storms' Source Code compares the breakeven cost to the day-ahead and real-time energy prices, and then

(i) sends signals to turn off all miners connected to the BearBox System if either the energy price is greater than or equal to the breakeven cost, or (ii) sends signals to turn on all miners connected to the BearBox System if the energy price is less than the breakeven cost. Tr. 647:5-653:23, 658:23-659:3; TX-22; *see* FF at ¶ 47. Third, Storms admitted that he was not the first person to consider the energy cost to mine Bitcoin versus the revenue that could be earned mining Bitcoin, and based on that data, decide whether to mine or not based on profitability. *See* Tr. 144:11-16; Tr. 613:5-615:1. Storms' admission is corroborated by Plaintiffs' expert, McCamant, who testified that comparing the real-time energy market price to the day-ahead energy price to decide whether to sell power back was a well-known form of arbitrage before May 2019. Tr. 204:14-23. McCamant also agreed that curtailing consumption of energy when the price of power exceeds a certain threshold was well known before May 2019 and may even be the most common form of energy arbitrage. Tr. 204:24-205:12. Fourth, the Court has already found as a matter of fact that Defendants independently conceived of a system that monitored the price of power from the power grid, global mining hash rate, and the price of Bitcoin prior to receiving Storms' Email. *See* FF at ¶¶ 97-98.

145) Accordingly, the Court finds as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of, or communicated, the subject matter of claim 16 of the '433 patent. Based on this finding, the Court also finds as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 16 of the '433 patent.



## II. PLAINTIFFS' SOLE INVENTORSHIP CLAIM

### A. Legal Standard

“Patent issuance creates a presumption that the named inventors are the true and only inventors.” *Caterpillar Inc. v. Sturman Industries, Inc.*, 387 F.3d 1358, 1377 (Fed. Cir. 2004) (citing *Hess v. Advanced Cardiovascular Sys., Inc.*, 106 F.3d 976, 980 (Fed. Cir. 1997)). However, a party may rebut this presumption by proving, through clear and convincing evidence, that he is entitled to be named as an inventor and, thus, should have been included on the patent. *See Eli Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1358 (Fed. Cir. 2004); *Checkpoint Systems, Inc. v. All-Tag Sec. S.A.*, 412 F.3d 1331, 1338 (Fed. Cir. 2005). Although failure to include an actual inventor on a patent is ordinarily grounds for invalidating that patent, 35 U.S.C. § 256 explicitly permits a court to order the patent’s correction. *See Checkpoint Sys., Inc.*, 412 F.3d at 1338 (“If a patentee can demonstrate that inventorship can be corrected as provided by [35 U.S.C. § 256], a district court must order correction of the patent, thus saving it from being rendered invalid.” (quoting *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1350 (Fed. Cir. 1998))).

A claim of sole inventorship is predicated on proving that the proposed inventor conceived of the total patented invention. *Ferring B.V. v. Allergan, Inc.*, 166 F. Supp. 3d 415, 424 (S.D.N.Y. 2016); *see also Univ. of Pittsburgh of Commonwealth Sys. of Higher Educ. v. Hedrick*, 2008 WL 8627085, at \*7 (C.D. Cal. June 9, 2008) (“Plaintiffs must show that they conceived of every claim of the patent and that any contribution by [the named inventors] to the conception of each and every claim was insignificant.”). “Conception is the touchstone of inventorship, the completion of the mental part of invention,” and is generally understood to be “a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.” *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227-28 (Fed. Cir. 1994) (internal quotations

omitted). A party may demonstrate conception “only when the idea is so clearly defined in the inventor’s mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation.” *Id.* at 1228. Notably, “an inventor need not know that his invention will work for conception to be complete,” but rather “need only show that he had the idea; the discovery that an invention works is part of its reduction to practice.” *Id.* (citations omitted). Further, the proposed inventor “must also show that the person to be removed did not contribute to the invention of any of the allowed claims.” *Beriont v. GTE Labs., Inc.*, 601 F. App’x 937, 940 (Fed. Cir. 2015) (quoting *Univ. of Pittsburgh of Commonwealth Sys. of Higher Educ. v. Hedrick*, 573 F.3d 1290, 1297 (Fed. Cir. 2009)) (internal quotations omitted).

As a claim of sole inventorship requires proof by clear and convincing evidence, the party seeking to be added as an inventor “must prove his conception by corroborating evidence, preferably by showing a contemporaneous disclosure.” *Id.* at 1228. This is so because of “the temptation for even honest witnesses to reconstruct, in a manner favorable to their own position, what their state of mind may have been years earlier.” *Hess*, 106 F.3d at 980 (internal quotations and citations omitted). Therefore, “[a]n alleged co-inventor’s testimony, or the testimony of the inventor himself, standing alone, cannot provide clear and convincing evidence of conception.” *Univ. of Pittsburg*, 2008 WL 8627085, at \*9 (citing *Caterpillar Inc.*, 387 F.3d at 1377). Instead, the inventor must independently corroborate its alleged conception through “testimony of a witness . . . to the actual reduction to practice,” or “evidence of surrounding facts and circumstances independent of information received from the inventor.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1171 (Fed. Cir. 2006). Documentary or physical evidence made contemporaneously with the inventive process generally provides the most reliable proof of corroboration. *See Sandt Tech., Ltd. v. Resco Metal & Plastics Corp.*, 264 F.3d 1344, 1350-51



(Fed. Cir. 2001). Ultimately, the Court evaluates the sufficiency of the corroborating evidence under a “rule of reason” analysis, which requires evaluating all pertinent evidence so that a sound determination of credibility of the alleged inventor’s story may be reached. *Ethicon, Inc. v. U.S. Surgical Corp.*, 135 F.3d 1456, 1464 (Fed. Cir. 1998).

## **B. Discussion**

Plaintiffs argue that, because Storms solely conceived of all the claimed subject matter of the ’433 patent, the inventorship of the ’433 patent should be corrected to reflect that Austin Storms is the sole inventor. D.I. 256 at 2; D.I. 260 at 9. The Court has already found as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms conceived of elements [b2], [b3], or [b4] of claim 1 of the ’433 patent. *See* FF at ¶¶ 106, 110, 114. Moreover, the Court has also found as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms communicated preamble [a] of claims 1, 17, and 20 or elements [b] and [b1] of claim 1 of the ’433 patent prior to Defendants’ independent conception. *See* FF at ¶¶ 95, 98. Accordingly, as a matter of law, Plaintiffs have not established that Storms is the sole inventor of the claimed inventions of the ’433 patent.<sup>5</sup>

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<sup>5</sup> Throughout its post-trial briefing, Plaintiffs continually criticize Defendants for not presenting testimonial evidence regarding McNamara and Cline’s independent conception of the claimed inventions of the ’433 patent. *See, e.g.*, D.I. 256 at 18-20; D.I. 260 at 5-6. This, however, is a red herring. “Patent issuance creates a presumption that the named inventors are the true and only inventors.” *Caterpillar Inc.*, 387 F.3d at 1377 (citing *Hess*, 106 F.3d at 980). It is Plaintiffs’ burden to prove, by clear and convincing evidence, that Storms conceived of the claimed inventions of the ’433 patent. *Burroughs Wellcome*, 40 F.3d at 1227-28. While McNamara and Cline’s actions inform the Court’s analysis under the “rule of reason,” *see Ethicon, Inc.*, 135 F.3d at 1464-65, the burden to establish, through corroborating evidence, that Storms conceived of each claim of the ’433 patent remains with Plaintiffs.

### III. PLAINTIFFS' JOINT INVENTORSHIP CLAIM

#### A. Legal Standard

A purported joint inventor who was erroneously omitted from a patent may seek the correction of the patent in federal court. *See* 35 U.S.C. § 256. However, the purported joint inventor must overcome the presumption that the named inventors of a patent are correct by meeting the heavy burden of proving his case by clear and convincing evidence. *Hess*, 106 F.3d at 980. To satisfy this standard, the claimed joint inventor must provide evidence corroborating his testimony concerning conception of the invention, including contemporaneous documentary or physical evidence, oral testimony of others, and circumstantial evidence. *See Ethicon, Inc.*, 135 F.3d at 1461; *Trovan, Ltd.*, 299 F.3d at 1303. The Court evaluates the sufficiency of the claimed joint inventor's corroborating evidence under a "rule of reason" analysis, whereby the Court views all evidence before making a sound determination as to the credibility of the claimed inventor's story. *See Trovan, Ltd.*, 299 F.3d at 1295.

Joint inventorship differs from sole inventorship in that "[a] joint invention is the product of a collaboration between two or more persons working together to solve the problem addressed." *Burroughs Wellcome*, 40 F.3d at 1227 (citing 35 U.S.C. § 116; *Kimberly-Clark Corp. v. Procter & Gamble Distrib. Co.*, 973 F.2d 911, 917 (Fed. Cir. 1992)). People may be joint inventors "even though they do not physically work on the invention together or at the same time, and even though each does not make the same type or amount of contribution." *Id.* However, the "individual must make a contribution to the conception of the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention." *Fina Oil & Chem. Co. v. Ewen*, 123 F.3d 1466, 1473 (Fed. Cir. 1997); *see also Eli Lilly & Co.*, 376 F.3d at 1358; *Ethicon Inc.*, 135 F.3d at 1460. There is no "lower limit on the quantum or quality of the inventive



contribution required for a person to qualify as a joint inventor,” and a meaningful contribution to the conception of even one claim in a patent can suffice to establish inventorship. *Id.* (citation and quotation marks omitted); *Cook Biotech Inc. v. Acell, Inc.*, 460 F.3d 1365, 1373 (Fed. Cir. 2006); *Eli Lilly & Co.*, 376 F.3d at 1358-59 (referring to the inventors having “some open line of communication during or in temporal proximity to their inventive efforts.”). That is to say that joint inventors need not (1) “physically work together or at the same time,” (2) “make the same type or amount of contribution,” or (3) “make a contribution to the subject matter of every claim of the patent.” *Vanderbilt Univ. v. ICOS Corp.*, 601 F.3d 1297, 1302 (Fed. Cir. 2010) (citation omitted); *Kimberly-Clark*, 973 F.2d at 917 (joint behavior may include “collaboration or working under common direction, one inventor seeing a relevant report and building upon it or hearing another’s suggestion at a meeting.”). However, a joint inventor must “do more than merely explain to the real inventors well-known concepts and/or the current state of the art,” *Magnetar Techs. Corp. v. Six Flags Theme Parks, Inc.*, No. 07-127-LPS-MPT, 2017 WL 962760, at \*7 (D. Del. Mar. 13, 2017) (quoting *Pannu*, 155 F.3d at 1351), and cannot “merely suggest[] an idea of a result to be accomplished, rather than means of accomplishing it . . .” *Nartron Corp. v. Schukra U.S.A., Inc.*, 558 F.3d 1352, 1359 (Fed. Cir. 2009) (quoting *Garrett Corp. v. United States*, 422 F.2d 874, 881 (Ct. Cl. 1970)).

Ultimately, “[t]he determination of whether a person is a joint inventor is fact specific, and no bright-line standard will suffice in every case.” *Fina Oil & Chem.*, 123 F.3d at 1473.

## **B. Discussion**

Plaintiffs argue that, at a minimum, Storms conceived of some of the claimed subject matter of the ’433 patent and, thus the inventorship of the ’433 patent should be corrected to reflect that Storms is a joint inventor. D.I. 256 at 15; D.I. 260 at 8-9. Specifically, Plaintiffs assert that

Storms' Email satisfies the collaboration requirement for joint inventorship, *see* D.I. 256 at 16-17, while Storms' contribution to the conception of some of the claims of the '433 patent—specifically, the “monitored conditions” limitation recited in each claim, and claim 16—was significant in both quantity and quality. *Id.* at 17-18.

Plaintiffs assert that “Storms' contribution of monitored conditions, as recited in all 20 claims, was a significant contribution that forms a basis upon which the other aspects of the claim are built,” which, together with communicating this concept to Defendants through Storms' Email, entitles Storms to be named a joint inventor of the '433 patent. *Id.* at 17-18. The Court has already found as a factual matter that Plaintiffs have failed to prove by clear and convincing evidence that Storms communicated the “monitored conditions” limitation, i.e., element [b1], of claims 1, 17, and 20 of the '433 patent prior to Defendants' independent conception. *See* FF at ¶ 98. Accordingly, as a matter of law, Plaintiffs have not established that Storms is a joint inventor with respect to the “monitored conditions” limitations recited in each claim of the '433 patent.

Additionally, Plaintiffs assert that “Storms [] made a significant contribution in the form of his profitability analysis embodied in claim 16,” because, as shown in Storms' Data File, the BearBox System “compared the revenue obtained by performing mining operations for Bitcoin (mining\_rev, column H), and mined Bitcoin in circumstances in which the price of power from the grid (real\_time\_LMP, column J) was equal or less than the revenue obtainable from mining Bitcoin.” D.I. 256 at 18. The Court has already found as a matter of fact that Plaintiffs have failed to prove by clear and convincing evidence that Storms conceived of, or communicated, the subject matter of claim 16 of the '433 patent. *See* FF at ¶ 145. Further, the Court also found as a factual matter that Plaintiffs failed to establish by clear and convincing evidence that Storms' Email significantly contributed to the subject matter of claim 16 of the '433 patent. *See* FF at ¶ 145.



Accordingly, as a matter of law, Plaintiffs have not established that Storms is a joint inventor with respect to claim 16 of the '433 patent.

Storms' purported contribution to the other claims of the '433 patent fare no better. The Court has already found as a matter of fact that Plaintiffs have failed to establish by clear and convincing evidence that Storms conceived of elements [b2], [b3], or [b4] of claim 1 of the '433 patent. *See* FF at ¶¶ 106, 110, 114. Moreover, the Court has also found as a matter of fact that Plaintiffs did not establish by clear and convincing evidence that Storms communicated preamble [a] of claims 1, 17, and 20 or elements [b] and [b1] of claim 1 of the '433 patent prior to Defendants' independent conception. *See* FF at ¶¶ 95, 98. Accordingly, as a matter of law, Plaintiffs have not established that Storms is a joint inventor of claim 1 of the '433 patent.

As to dependent claims 3-8, 11-14, 18, and 19 of the '433 patent, the Court has already found as a matter of fact that Plaintiffs failed to establish by clear and convincing evidence that Storms conceived of the subject matter of dependent claims 3-8, 11-14, 18, and 19. *See* FF at ¶¶ 121, 126, 130, 138-140. Based on these findings, the Court also found as a matter of fact that Plaintiffs failed to establish by clear and convincing evidence that Storms significantly contributed to the conception of dependent claims 3-8, 11-14, 18, and 19. *See* FF at ¶¶ 121, 126, 130, 138-140. Accordingly, as a matter of law, Plaintiffs have not established that Storms is a joint inventor of claims 3-8, 11-14, 18, and 19 of the '433 patent. Finally, as to dependent claims 2, 9, 10, and 12 of the '433 patent, the Court has already found as a matter of fact that Plaintiffs failed to establish by clear and convincing evidence that Storms communicated of the subject matter of dependent claims 2, 9, 10, and 12 prior to Defendants' independent conception. *See* FF at ¶¶ 118, 135, 137, 139. Given these findings, the Court also found as a matter of fact that Plaintiffs failed to prove by clear and convincing evidence that Storms' Email significantly contributed to



dependent claims 2, 9, 10, and 12 of the '433 patent because Defendants had independently conceived of the subject matter prior to receiving Storms' Email. *See* FF at ¶¶ 118, 135, 137, 139. Accordingly, as a matter of law, Plaintiffs have not established that Storms is a joint inventor of claims 2, 9, 10, and 12 of the '433 patent.

#### **IV. CONCLUSION**

For the reasons discussed above, the Court finds that Plaintiffs have not met their burdens to establish their sole and/or joint inventorship claims. Accordingly, the Court will enter judgment in favor of Defendants.

The Court will issue an Order directing the parties to submit a proposed order by which the Court may enter final judgment consistent with this Opinion.

**IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE**

BEARBOX LLC and AUSTIN  
STORMS,

Plaintiffs,

v.

LANCIUM LLC,  
MICHAEL T. MCNAMARA, and  
RAYMOND E. CLINE, JR.,

Defendants.

C.A. No. 21-534-GBW-CJB

**FINAL JUDGMENT**

This action, having come before the Court for a bench trial from December 6 through December 8, 2022, the Honorable Gregory B. Williams, United States District Judge, presiding, and the Court having heard the evidence and testimony of witnesses of Plaintiffs BearBox LLC and Austin Storms (collectively, “Plaintiffs”) and Defendants Lancium LLC, Michael T. McNamara, and Raymond E. Cline, Jr. (collectively, “Defendants”);

AND WHEREAS the Court issued a post-trial Opinion (D.I. 262) and Order (D.I. 263) on March 6, 2023, finding in favor of Defendants and against Plaintiffs on Count I and Count II of Plaintiffs’ Second Amended Complaint (D.I. 103) (the “SAC”), which alleged claims seeking to correct inventorship for U.S. Patent No. 10,608,433 (the “’433 Patent”) to name Austin Storms as the sole or a joint inventor of the ’433 Patent;

AND WHEREAS the Court issued a Minute Entry on April 25, 2022 striking Count III and Count IV of the SAC, which alleged claims of trade secret misappropriation against Defendants;

AND WHEREAS the Court issued a Memorandum Opinion (D.I. 212) and Order (D.I. 213) on October 7, 2022, adopting a Report and Recommendation issued on May 26, 2022

(D.I. 143), dismissing with prejudice Count VI of the SAC alleging unjust enrichment against Defendants;

AND WHEREAS the Court issued a Memorandum Opinion (D.I. 230) and Order (D.I. 231) on November 14, 2022 granting summary judgment in favor of Defendants and against Plaintiffs on Count V of the SAC alleging conversion against Defendants;

AND WHEREAS the Court issued an Order (D.I. 97) on February 2, 2022, adopting a Report and Recommendation issued on January 18, 2022 (D.I. 92), dismissing with prejudice Count V (negligent misrepresentation) of Plaintiffs' Amended Complaint (D.I. 19);

**IT IS HEREBY ORDERED AND ADJUDGED**, as of the date written below, that **Final Judgment is entered as follows**:

1. Final Judgment is entered in favor of Defendants and against Plaintiffs on Count I of the SAC seeking to correct inventorship of the '433 Patent under 35 U.S.C. § 256 to name Austin Storms the sole inventor of the '433 Patent;
2. Final Judgment is entered in favor of Defendants and against Plaintiffs on Count II of the SAC seeking to correct inventorship of the '433 Patent under 35 U.S.C. § 256 to name Austin Storms a joint inventor of the '433 Patent;
3. Final Judgment is entered in favor of Defendants and against Plaintiffs on Counts III-VI of the SAC alleging trade secret misappropriation, conversion, and unjust enrichment, respectively;
4. Final Judgment is entered in favor of Defendants and against Plaintiffs on Count V of the Amended Complaint alleging negligent misrepresentation;

5. Final Judgment is entered in favor of Defendants and against Plaintiffs on Count I of Defendants' Second Amended Counterclaims (D.I. 145) (the "Counterclaims") seeking declaratory judgment that Austin Storms is not an inventor of the '433 Patent;

6. Final Judgment is entered in favor of Defendants and against Plaintiffs on Count II of the Counterclaims seeking declaratory judgment that Austin Storms has no ownership rights in the '433 Patent;

7. Final Judgment is entered in favor of Defendants and against Plaintiffs on Count III of the Counterclaims seeking declaratory judgment that Defendants did not steal or otherwise improperly obtain or use any information from Plaintiffs.

**IT IS FURTHER ORDERED** that the deadline for any party to move for costs and/or attorney's fees (including, but not limited to, under 35 U.S.C. § 285) is fourteen (14) days after the entry of this Final Judgment.

SO ORDERED AND FINAL JUDGMENT IS HEREBY ENTERED

this 5<sup>th</sup> day of April, 2023.

  
\_\_\_\_\_  
THE HONORABLE GREGORY B. WILLIAMS  
UNITED STATES DISTRICT JUDGE



IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

BEARBOX LLC and AUSTIN STORMS,

Plaintiffs,

v.

LANCIUM LLC, MICHAEL T.  
MCNAMARA, and RAYMOND E.  
CLINE, JR.,

Defendants.

C.A. No. 21-534-GBW

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Andrew C. Mayo, ASHBY & GEDDES, Wilmington, Delaware; Benjamin T. Horton, John R. Labbe, Raymond R. Ricordati III, Chelsea M. Murray, MARSHALL, GERSTEIN & BORUN LLP, Chicago, Illinois

*Counsel for Plaintiffs*

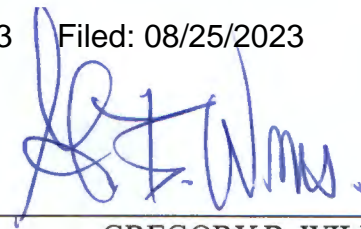
Chad. S.C. Stover, Mark C. Nelson, Darrick J. Hooker, Adam M. Kaufmann, Dana Amato Sarros, David M. Lisch, BARNES & THORNBURG LLP, Wilmington, Delaware

*Counsel for Defendants*

**MEMORANDUM OPINION**

**FILED UNDER SEAL**  
November 14, 2022  
Wilmington, Delaware





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GREGORY B. WILLIAMS  
UNITED STATES DISTRICT JUDGE

Plaintiffs BearBox LLC and Austin Storms (collectively, “BearBox”) filed this action against Defendants Lancium LLC, Michael T. McNamara, and Raymond E. Cline, Jr. (collectively, “Lancium”), seeking to correct the inventorship of United States Patent No. 10,608,433 (“the ’433 patent”), which is assigned to Lancium and lists Michael T. McNamara (“McNamara”) and Raymond E. Cline, Jr. (“Cline”) as inventors. Additionally, BearBox seeks to recover for Lancium’s conversion of BearBox’s technology, which is alleged to have been implemented into Lancium’s Smart Response™ software. Pending before the Court is Lancium’s First Motion for Summary Judgment as to all of BearBox’s claims. D.I. 148. The Court has reviewed the parties’ respective briefing, statement of facts, and responses thereto. *See, e.g.*, D.I. 148; D.I. 149; D.I. 150; D.I. 151; D.I. 176; D.I. 177; D.I. 178; D.I. 179; D.I. 195; D.I. 196. For the reasons explained below, Lancium’s First Motion for Summary Judgment is granted-in-part and denied-in-part.

## **I. BACKGROUND**

BearBox and Lancium are technology companies at the crossroads of the cryptocurrency and renewable energy industries. Their dispute centers around a meeting and subsequent communications between BearBox’s founder, Austin Storms, and Lancium’s CEO, Michael T. McNamara, beginning at the Fidelity FCAT Mining Summit in Boston, Massachusetts on May 3, 2019. Based on this string of communications from May 3 to May 9, 2019, BearBox filed this suit against Lancium, asserting claims of sole inventorship, or alternatively, joint inventorship, of the ’433 patent, theft of trade secrets, conversion, and unjust enrichment. D.I. 1; D.I. 103.

The Court struck BearBox’s trade secret claims on April 22, 2022. D.I. 111. Shortly thereafter, Lancium filed a Motion to Dismiss BearBox’s conversion and unjust enrichment claims

(D.I. 120), which the Court granted-in-part and dismissed the unjust enrichment claim. D.I. 212; D.I. 213. Lancium then filed its First Motion for Summary Judgment related to all remaining claims (D.I. 148), and later filed its Second Motion for Summary Judgment Regarding Damages and its Motion to Exclude Opinions of BearBox’s Expert David Duski (D.I. 167). On October 31, 2022, Lancium filed its Motion to Bifurcate BearBox’s Patent Inventorship Claims from BearBox’s Conversion Claims, and requested expedited consideration. D.I. 222.

Lancium’s First Motion for Summary Judgment (“Lancium’s Motion”) asserts that BearBox’s inventorship claims fail as a matter of law because there is no evidence that Austin Storms conceived of, communicated, or collaborated on the inventions of the ’433 patent. D.I. 149 at 1-2. Additionally, Lancium’s Motion argues that BearBox’s conversion claim fails as a matter of law because it is barred by Louisiana’s one-year statute of limitations and, alternatively, is preempted by federal patent law. D.I. 149 at 30-36. BearBox disputes Lancium’s Motion. D.I. 176; D.I. 177; D.I. 178; D.I. 179. To aid in the resolution of Lancium’s Motion, the Court held a *Markman* hearing on October 20, 2022, and later issued a *Markman* opinion construing two disputed terms of the ’433 patent: “power option agreement” and “minimum power threshold.” D.I. 218; D.I. 219. Lancium’s Motion is now ripe for resolution.

## II. LEGAL STANDARD

“The court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law.” Fed. R. Civ. P. 56(a). Material facts are those “that could affect the outcome” of the proceeding. *Lamont v. New Jersey*, 637 F.3d 177, 181 (3d Cir. 2011) (quoting *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1986)). “[A] dispute about a material fact is ‘genuine’ if the evidence is sufficient to permit a reasonable jury to return a verdict for the nonmoving party.” *Id.* “The burden on the moving party may be discharged by pointing out to the district court that there is an absence of



evidence supporting the non-moving party's case." *Peloton Interactive, Inc. v. iFIT Inc.*, C.A. No. 20-1535-RGA, 2022 WL 1523112, at \*1 (D. Del. May 13, 2022) (citing *Celotex Corp. v. Catrett*, 477 U.S. 317, 323 (1986)).

The burden then shifts to the non-movant to demonstrate the existence of a genuine issue for trial. *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 586-87 (1986); *Williams v. Borough of West Chester*, 891 F.2d 458, 460-61 (3d Cir. 1989). A non-moving party asserting that a fact is genuinely disputed must support such an assertion by: "(A) citing to particular parts of materials in the record, including depositions, documents, electronically stored information, affidavits or declarations, stipulations . . . , admissions, interrogatory answers, or other materials; or (B) showing that the materials cited [by the opposing party] do not establish the absence . . . of a genuine dispute . . . ." Fed. R. Civ. P. 56(c)(1).

When determining whether a genuine issue of material fact exists, the court must view the evidence in the light most favorable to the non-moving party and draw all reasonable inferences in that party's favor. *Wishkin v. Potter*, 476 F.3d 180, 184 (3d Cir. 2007). If the non-moving party fails to make a sufficient showing on an essential element of its case with respect to which it has the burden of proof, the moving party is entitled to judgment as a matter of law. *See Celotex Corp.*, 477 U.S. at 322.

### III. DISCUSSION

Lancium argues that the Court must grant summary judgment as to BearBox's claims of sole and joint inventorship because BearBox has failed to produce any evidence that Austin Storms conceived of, or communicated to Lancium, the inventions claimed in the '433 patent. D.I. 149 at 9, 30. Separately, Lancium asserts that it is also entitled to summary judgment as to BearBox's joint inventorship claim because BearBox fails to proffer evidence that Austin Storms collaborated

with the named inventors of the '433 patent. Finally, Lancium argues that the Court must grant summary judgment as to BearBox's conversion claim because it is time-barred by Louisiana's one-year statute of limitations, or that BearBox's conversion claim is preempted by federal patent law. *Id.* at 30-36. BearBox disputes each of Lancium's arguments, asserting that the record is replete with genuine disputes of material fact that preclude summary judgment on all of BearBox's claims. *See* D.I. 176. The Court finds that there are genuine issues of material fact precluding summary judgment as to BearBox's sole and joint inventorship claim. However, the Court finds that Lancium is entitled to summary judgment as to BearBox's conversion claim.

#### **A. Sole Inventorship**

Lancium moves for summary judgment as to BearBox's sole inventorship claim, arguing that BearBox has failed to produce any evidence that Austin Storms conceived of, or communicated to Lancium, the inventions claimed in the '433 patent. D.I. 149 at 9. In response, BearBox asserts that there exists genuine issues of material fact regarding Storms' conception of the inventions claimed in the '433 patent that preclude summary judgment. D.I. 176 at 19. Further, BearBox avers that summary judgment must be denied because both testimony and documents produced as evidence corroborate BearBox's claim that Storms communicated the entirety of the inventions claimed in the '433 patent to Lancium. *Id.* at 25. Because the Court finds that the parties have genuine disputes of material fact as to what Austin Storms conceived of and what was communicated to Lancium, Lancium's Motion as to BearBox's sole inventorship claim is denied.

"Patent issuance creates a presumption that the named inventors are the true and only inventors." *Caterpillar Inc. v. Sturman Industries, Inc.*, 387 F.3d 1358, 1377 (Fed. Cir. 2004) (citing *Hess v. Advanced Cardiovascular Sys., Inc.*, 106 F.3d 976, 980 (Fed. Cir. 1997)). However, a party may rebut this presumption by proving, through clear and convincing evidence, that he is entitled to be named as an inventor and, thus, should have been included on the patent. *See Eli*



*Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1358 (Fed. Cir. 2004); *Checkpoint Systems, Inc. v. All-Tag Sec. S.A.*, 412 F.3d 1331, 1338 (Fed. Cir. 2005). Although failure to include an actual inventor on a patent is ordinarily grounds for invalidating that patent, 35 U.S.C. § 256 explicitly permits a court to order the patent's correction. *See Checkpoint Sys., Inc.*, 412 F.3d at 1338 ("If a patentee can demonstrate that inventorship can be corrected as provided by [35 U.S.C. § 256], a district court must order correction of the patent, thus saving it from being rendered invalid." (quoting *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1350 (Fed. Cir. 1998))).

A claim of sole inventorship is predicated on proving that the proposed inventor conceived of the total patented invention. *Ferring B.V. v. Allergan, Inc.*, 166 F. Supp. 3d 415, 424 (S.D.N.Y. 2016); *see also Univ. of Pittsburgh of Commonwealth Sys. of Higher Educ. v. Hedrick*, 2008 WL 8627085, at \*7 (C.D. Cal. June 9, 2008) ("Plaintiffs must show that they conceived of every claim of the patent and that any contribution by [the named inventors] to the conception of each and every claim was insignificant."). "Conception is the touchstone of inventorship, the completion of the mental part of invention," and is generally understood to be "a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice." *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227-28 (Fed. Cir. 1994) (internal quotations omitted). A party may demonstrate conception "only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation." *Id.* at 1228. Notably, "an inventor need not know that his invention will work for conception to be complete," but rather "need only show that he had the idea; the discovery that an invention works is part of its reduction to practice." *Id.* (citations omitted).



As a claim of sole inventorship requires proof by clear and convincing evidence, the party seeking to be added as an inventor “must prove his conception by corroborating evidence, preferably by showing a contemporaneous disclosure.” *Id.* at 1228. This is so because of “the temptation for even honest witnesses to reconstruct, in a manner favorable to their own position, what their state of mind may have been years earlier.” *Hess*, 106 F.3d at 980 (internal quotations and citations omitted). Therefore, “[a]n alleged co-inventor’s testimony, or the testimony of the inventor himself, standing alone, cannot provide clear and convincing evidence of conception.” *Univ. of Pittsburg*, 2008 WL 8627085, at \*9 (citing *Caterpillar Inc.*, 387 F.3d at 1377). Instead, the inventor must independently corroborate its alleged conception through “testimony of a witness . . . to the actual reduction to practice,” or “evidence of surrounding facts and circumstances independent of information received from the inventor.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1171 (Fed. Cir. 2006). Documentary or physical evidence made contemporaneously with the inventive process generally provides the most reliable proof of corroboration. *See Sandt Tech., Ltd. v. Resco Metal & Plastics Corp.*, 264 F.3d 1344, 1350-51 (Fed. Cir. 2001). Ultimately, the Court evaluates the sufficiency of the corroborating evidence under a “rule of reason” analysis, which requires evaluating all pertinent evidence so that a sound determination of credibility of the alleged inventor’s story may be reached. *Ethicon, Inc. v. U.S. Surgical Corp.*, 135 F.3d 1456, 1464 (Fed. Cir. 1998).

The ’433 patent comprises of twenty claims that generally relate to systems and methods for adjusting the amount of power available on the electrical grid based on interactions with the ancillary services markets. *See* ’433 patent at Abstract. BearBox alleges that Austin Storms alone conceived of the subject matter in the ’433 patent because Lancium merely commercialized Austin Storms’ systems and methods—through Lancium’s Smart Response™ software—after unlawfully

obtaining BearBox's proprietary technical documents during and after the Fidelity FCAT Mining Summit. D.I. 176 at 6-12. BearBox bases its sole inventorship claim on the following evidence: (1) a Product Details document emailed to Lancium which describes features related to a system operating at a maximum power load and having different power usage capabilities over specified periods of time, *see, e.g.*, D.I. 178 at ¶ 5; D.I. 179, Ex. E at 112:4-115:13 at 95:12; *id.* at Ex. B; (2) a diagram titled "BearBox Automatic Mining System Version 1.0," showing alternative periods of mining Bitcoin and curtailment based on external variables such as price of power, *see* D.I. 179, Ex. B; (3) an expert report detailing how BearBox's annotated diagram shows a system that "would operate with power generation assets and the software would continually determine whether it was more profitable to use the electricity from the generation assets to mine Bitcoin or to sell the electricity at the day-ahead or real-time LMP pricing," *see* D.I. 179, Ex. C at ¶ 64; *see also* D.I. 151, Ex. 3 at 53-80; (4) a proprietary .CSV file manipulating and modeling data to show mining or curtailment decisions being determined at regular time intervals, *see* D.I. 179, Ex. B; *see also id.*, Ex. H at 139-150; (5) and Storms' own detailed testimony related to his purported conception of the claimed invention and the events surrounding Storms and McNamara's communications, *see* D.I. 179, Ex. E at 86-113.

Viewing the evidence in the light most favorable to BearBox and drawing all reasonable inferences in its favor, *Wishkin*, 476 F.3d at 184, the Court finds that BearBox, at a minimum, has demonstrated the existence of genuine issues of material fact related to Austin Storms' conception of the subject matter of the '433 patent. At this stage, the present record is replete with testimony and documents that could support a factfinder's reasonable inference that Austin Storms conceived of the '433 patent's subject matter, as properly construed by this Court, prior to Lancium's purported conception. *See* D.I. 178 at ¶ 5; *see also* D.I. 179, Ex. A (undated images of BearBox's



hardware and software, and images of whiteboard drawings depicting BearBox's purported conception of the subject matter claimed in the '433 patent). Specifically, Storms testifies extensively to the details shared over dinner with McNamara, including a concept for software that provides fine grain control over mining machines and a system that could maximize profitability by calculating the most profitable times to mine for Bitcoin or curtail activities and sell power back to the grid. D.I. 179, Ex. E at 95:12-105:16. Acknowledging that an alleged inventor's own testimony is viewed with suspicion, *see Sandt Tech.*, 264 F.3d at 1350-51, BearBox corroborates the substance of Storms' communications through the Product Details document and the proprietary .CSV file, both of which were undisputedly emailed to Lancium following the dinner with McNamara. *See* D.I. 150 at ¶ 13; D.I. 177 at ¶ 13; D.I. 178 at ¶ 5. Using these documents, BearBox's expert, Dr. McClellan, maps each limitation claimed in the '433 patent to the systems and methods allegedly conceived by Storms.<sup>1</sup> *See* D.I. 151, Ex. 3 at 57-80.

Furthermore, Dr. McClellan identifies over forty functional source code files Storms disputedly created prior to his communications with McNamara, which BearBox alleges proves Storms' conception of all the claimed aspects of the '433 patent, including the retrieval of data from remote sources, profitability determinations, and controlling relays to power on miners. D.I. 176 at 26-27; *see also* D.I. 151, Ex. 3 at ¶¶ 54-169; D.I. 151 at Appendix A. BearBox asserts that, while Lancium never obtained these source code files, these files demonstrate a reduction to practice that is indicative of Storms' conception of the '433 patent's subject matter. D.I. 176 at 26-27; *see also Trovan, Ltd. V. Sokymat SA, Irori*, 299 F.3d 1292, 1309 (Fed. Cir. 2002)

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<sup>1</sup> To the extent Lancium argues that the corroborating documents BearBox cites do not use the terms, as properly construed, that are explicitly used in the '433 patent, it is understood that the original inventor need only demonstrate possession of the claimed subject matter—the inventor need not use a particular claim term. *Apotex Inc. v. Cephalon, Inc.*, 2011 WL 6090696, at \*18 (E.D. Pa. Nov. 7, 2011), *aff'd*, 500 F. App'x 959 (Fed. Cir. 2013).

(“[R]eduction to practice alone is evidence that [plaintiff] had a definite and permanent idea of the complete and operative invention.”). In essence, BearBox’s submissions with respect to the conception of the ’433 patent’s subject matter present ample analysis of, and support for, his claim of sole inventorship, as well as extensive analysis of both the scientific processes at issue and of the language in the patents themselves. Additionally, BearBox has demonstrated the potential for adequate corroboration, through both direct and circumstantial evidence, that Storms conceived of each limitation claimed in the ’433 patent prior to Storms’ communications with McNamara. *See, e.g.,* D.I. 151, Ex. 3 at 57-80; D.I. 151 at Appendix A; D.I. 150 ¶¶ 13, 17; D.I. 177 at ¶¶ 13, 17. As such, BearBox has established the existence of genuine issues of material fact that preclude Lancium’s Motion as to sole inventorship.

While Lancium contends that the present record is devoid of any evidence that supports BearBox’s claim that Storms conceived of the entirety of the claimed subject matter of the ’433 patent, Lancium’s argument centers on disputes about the substance and weight of the testimony and corroborating documents that BearBox cites. D.I. 149 at 19-24; D.I. 195 at 11-15. Stated another way, Lancium disputes material facts that are essential to the resolution of who conceived of the subject matter of the ’433 patent. At this stage, the Court is not equipped to weigh the volumes of evidence, especially in light of the fact that BearBox has established the existence of genuine issues of material fact. *See BASF Corp. v. SNF Holding Co.*, 955 F.3d 958, 963 (Fed. Cir. 2020) (“[A]t the summary judgment stage the judge’s function is not himself to weigh the evidence . . . .” (internal quotation marks and citation omitted)). Additionally, Lancium conflates the required proof for corroboration. Lancium contends that the Federal Circuit in *Wagner v. Ashline*, 2021 WL 5353889 (Fed. Cir. Nov. 17, 2021) held that evidence corroborating only that the named inventor and alleged inventor met and discussed other topics is insufficient to meet the



corroboration standard. D.I. 149 at 23; D.I. 195 at 15. But, *Wagner* was not decided so narrowly. Rather, the Federal Circuit was concerned that the only probative evidence corroborating the alleged inventor's claim was from a non-party who testified that the meeting was focused on topics outside of the scope of the asserted patents. *Wagner*, 2021 WL 5353889, at \*4-5. In fact, applying a "rule of reason" analysis, the Federal Circuit held that only testimony corroborating that the named inventor and alleged inventor met and discussed other topics, ***without additional documentary or testimonial evidence***, is by itself insufficient to meet the corroboration standard. *Id.* at \*5 (emphasis added). Here, unlike *Wagner*, BearBox does not corroborate its inventorship claim solely through the testimony of Storms or a non-party; rather, BearBox offers testimonial evidence, expert reports, and contemporaneous technical documents to support its claim. *See, e.g.*, D.I. 151, Ex. 3 at 57-80; D.I. 151 at Appendix A; D.I. 178 at ¶¶ 4, 5.

Although BearBox's case for sole inventorship of the '433 patent may be less convincing with respect to some contributions or claims than it is for others, diving into the factual morass of analyzing each claim, a litany of technical documents, and source code files is not a task appropriate for the Court at the summary judgment stage. It is enough that the parties' respective submissions on this issue indicate the existence of disputed material facts that go directly to the heart of BearBox's claim of sole inventorship. Faced with all of the available documentary evidence, expert testimony, and disputed facts, the Court cannot say that no reasonable fact finder could find that there is clear and convincing evidence establishing Storms' right to be named as the sole inventor on the '433 patent. Summary judgment as to BearBox's sole inventorship claim is denied.

#### **B. Joint Inventorship**

Separately, Lancium argues that BearBox's joint inventorship claim fails as a matter of law because BearBox has failed to meet its burden of proving Storms collaborated on the inventions



claimed in the '433 patent. D.I. 149 at 24. As such, Lancium asserts that it is entitled to summary judgment on BearBox's joint inventorship claim. *Id.* at 24-30. BearBox disagrees, arguing that summary judgment is precluded because there exist multiple genuine issues of material fact related to Storms' contribution to the '433 patent's subject matter. D.I. 176 at 27. The Court agrees with BearBox that there are genuine issues of material fact that preclude summary judgment on BearBox's joint inventorship claim.

Like sole inventorship, a purported joint inventor who was erroneously omitted from a patent may seek the correction of the patent in federal court. *See* 35 U.S.C. § 256. However, the purported joint inventor must overcome the presumption that the named inventors of a patent are correct by meeting the heavy burden of proving his case by clear and convincing evidence. *Hess*, 106 F.3d at 980. To satisfy this standard, the claimed joint inventor must provide evidence corroborating his testimony concerning conception of the invention, including contemporaneous documentary or physical evidence, oral testimony of others, and circumstantial evidence. *See Ethicon, Inc.*, 135 F.3d at 1461; *Trovan, Ltd.*, 299 F.3d at 1303. The Court evaluates the sufficiency of the claimed joint inventor's corroborating evidence under a "rule of reason" analysis, whereby the Court views all evidence before making a sound determination as to the credibility of the claimed inventor's story. *See Trovan, Ltd.*, 299 F.3d at 1295.

Joint inventorship differs from sole inventorship in that "[a] joint invention is the product of a collaboration between two or more persons working together to solve the problem addressed." *Burroughs Wellcome*, 40 F.3d at 1227 (citing 35 U.S.C. § 116; *Kimberly-Clark Corp. v. Procter & Gamble Distrib. Co.*, 973 F.2d 911, 917 (Fed. Cir. 1992)). People may be joint inventors "even though they do not physically work on the invention together or at the same time, and even though each does not make the same type or amount of contribution." *Id.* However, the "individual must

make a contribution to the conception of the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention.” *Fina Oil & Chem. Co. v. Ewen*, 123 F.3d 1466, 1473 (Fed. Cir. 1997); *see also Eli Lilly & Co.*, 376 F.3d at 1358; *Ethicon Inc.*, 135 F.3d at 1460. There is no “lower limit on the quantum or quality of the inventive contribution required for a person to qualify as a joint inventor,” and a meaningful contribution to the conception of even one claim in a patent can suffice to establish inventorship. *Id.* (citation and quotation marks omitted); *Cook Biotech Inc. v. Acell, Inc.*, 460 F.3d 1365, 1373 (Fed. Cir. 2006); *Eli Lilly & Co.*, 376 F.3d at 1358-59 (referring to the inventors having “some open line of communication during or in temporal proximity to their inventive efforts.”). That is to say that joint inventors need not (1) “physically work together or at the same time,” (2) “make the same type or amount of contribution,” or (3) “make a contribution to the subject matter of every claim of the patent.” *Vanderbilt Univ. v. ICOS Corp.*, 601 F.3d 1297, 1302 (Fed. Cir. 2010) (citation omitted); *Kimberly-Clark*, 973 F.2d at 917 (joint behavior may include “collaboration or working under common direction, one inventor seeing a relevant report and building upon it or hearing another’s suggestion at a meeting.”). Ultimately, “[t]he determination of whether a person is a joint inventor is fact specific, and no bright-line standard will suffice in every case.” *Fina Oil & Chem.*, 123 F.3d at 1473.

The crux of Lancium’s argument is that the record is devoid of any evidence that there was “joint behavior” or “collaboration” between Storms and the named inventors, McNamara and Cline.<sup>2</sup> D.I. 149 at 25. In fact, Lancium asserts that the only communications between the

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<sup>2</sup> Lancium further argues that “Storms cannot be a joint inventor as a matter of law because . . . he did not contribute in any significant manner (or at all) to any claims of the ’433 patent. Storms’ ‘system’ was fundamentally different from the system claimed in the ’433 patent.” D.I. 195 at 16. However, the evidence offered to establish that Storms conceived of the entirety of the subject matter claimed in the ’433 patent (i.e., to establish BearBox’s sole inventorship claim) is identical



parties—a conversation at a group dinner following the Fidelity FCAT Mining Summit, a series of text messages between Storms and McNamara from May 3 to May 9, 2019, and an email Storms sent to McNamara with five attachments—fail, as a matter of law, to establish collaboration between the parties. *Id.* Notably, Lancium contends, and BearBox does not dispute, that four of the five attachments emailed to McNamara were publicly available, which Lancium asserts further weighs against a finding of collaboration. *See* D.I. 150 at ¶ 18; D.I. 177 at ¶ 18 (conceding that the attachments, except the .CSV file, are not confidential by themselves, but asserting that the entirety of the email, including all attachments, are confidential by virtue of the “Confidentiality Notice” at the bottom of that email).

Ultimately, rather than contest that there was no corroborating evidence supporting a finding of collaboration, Lancium’s argument relates to the quantity and quality of the communications between the parties. In doing so, Lancium ignores the undisputed fact that McNamara communicated with Storms for the week following the Fidelity FCAT Mining Summit, including soliciting product details and supporting documents from Storms via text message. D.I. 150 at ¶ 12; D.I. 177 at ¶ 12; *see* D.I. 179, Ex. G (McNamara’s text messages to Storms, stating “I also think your boxes may have some benefits vs the ones we are doing with JB driver. Lots of stuff to collaborate on. . . . Storms, can you send me those box design specs please! . . . Also, have you ever looked at building a GPU box?”). This exchange corroborates Storms’ testimony that

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to the evidence that would be offered to prove a significant contribution to the conception of the invention that is required for a claim of joint inventorship. Lancium does not dispute the overlap in evidence, and in fact cites to the section of its brief arguing that the record is devoid of any evidence that Storms conceived of the entire claimed invention (i.e., the sole inventorship claim) in support of its contention that Storms made no significant contribution to warrant a finding of joint inventorship. D.I. 149 at 30. As such, the Court will not reiterate the genuine issues of material fact that exist related to Storms’ conception of the subject matter claimed in the ’433 patent. *See supra* Section III.A.

McNamara showed interest in BearBox's technology and believed that Storms may be valuable to McNamara's ongoing and future projects. D.I. 179, Ex. E at 95:12-110:6; 114:7-11 (Storms testifying that McNamara was interested in BearBox's technology during their dinner conversation). Also, it is undisputed that Storms responded to McNamara's texts by emailing McNamara five attachments, including the Product Details document and a proprietary .CSV file, which disputedly demonstrates Storms' conception of the claimed inventions of the '433 patent. D.I. 150 at ¶ 17; D.I. 177 at ¶ 17; D.I. 179, Ex. B; *see also supra* Section III.A. Despite the fact that the parties did not physically work on the invention together, Storms and McNamara plainly had an "open line of communication . . . in temporal proximity to their inventive efforts." *Eli Lilly & Co.*, 376 F.3d at 1359; *see also CODA Dev. S.R.O. v. Goodyear Tire & Rubber Co.*, 916 F.3d 1350, 1359-60 (Fed. Cir. 2019). Moreover, there is a genuine dispute as to whether the .CSV file emailed to McNamara, and later forwarded to Cline, was incorporated or implemented, in part or in whole, into the claimed invention of the '433 patent. *See* D.I. 179, Ex. H at 139-150 (Cline testifying that when the .CSV file was forwarded to him, he understood the column headers, numerical values, and their respective mathematical relationships).

Lancium's reliance on *Rubin v. General Hospital Corp.*, 2011 WL 1625024 (D. Mass. Apr. 28, 2011), to cast doubt on the collaboration is misplaced. D.I. 195 at 16-17. In *Rubin*, the purported joint inventors and named inventors never had any direct communication. *Id.* at \*2, \*6. To show collaboration, the purported joint inventors relied on their awareness of the named inventors' research and their claim that one of the named inventors read their journal abstract. *Id.* at \*6. However, the Court found this evidence insufficient to establish collaboration, noting that the purported joint inventors filed their own provisional patent application after the alleged collaboration without including the named inventors. *Id.* at \*7. From this, the Court inferred that

the purported joint inventors did not consider themselves to be collaborating with the named inventors. *Id.* In the present case, however, the Court cannot conclude that no reasonable fact finder could find that there is clear and convincing evidence establishing collaboration between Storms and McNamara based on the following communications: (1) Storms and McNamara’s dinner conversation after the Fidelity FCAT Mining Summit—to which the parties dispute the extent of what information regarding BearBox’s technology, if any, was shared, *see, e.g.*, D.I. 150 at ¶ 11; D.I. 177 at ¶ 11; D.I. 179, Ex. E at 95:12-114:11; D.I. 179, Ex. F at 133-135; (2) Storms and McNamara’s exchange of text messages from May 3 to May 9, 2019, where McNamara undisputedly solicited information about BearBox’s product, *see, e.g.*, D.I. 150 at ¶ 12; D.I. 177 at ¶ 12; D.I. 179, Ex. G; and (3) responsive to McNamara’s solicitation, Storms sent an email to McNamara with five attachments including the Product Details document and the proprietary .CSV file, *see, e.g.*, D.I. 150 at ¶ 17; D.I. 177 at ¶ 17; D.I. 179, Ex. B.

Finally, Lancium’s assertion that the public availability of four of the five attachments emailed to McNamara precludes a finding of collaboration is based on a selective interpretation of *Univ. of Utah v. Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V.*, 851 F.3d 1317 (Fed. Cir. 2017). *See* D.I. 149 at 25-26. In *Univ. of Utah*, the Federal Circuit agreed with the district court’s finding that a published article, which was prior art to the claimed inventions, “could not, on its own, support a finding of collaboration.” 851 F.3d at 1321. However, and contrary to Lancium’s proposition, the Federal Circuit—just three paragraphs later—reiterated that “one inventor seeing a relevant report and building upon it might be an element of joint behavior supporting collaboration.” *Id.* at 1321-22 (citing *Kimberly-Clark*, 973 F.2d at 917). Therefore, the public nature of a document does not, by itself, preclude a finding of collaboration. *See Dana-Farber Cancer Inst., Inc. v. Ono Pharm. Co.*, 964 F.3d 1365, 1371-72 (Fed. Cir. 2020), *cert.*



*denied*, 141 S. Ct. 2691 (2021) (“Inventorship of a complex invention may depend on partial contributions to conception over time, and there is no principled reason to discount genuine contributions made by collaborators because portions of that work were published prior to conception for the benefit of the public.”). Because there are genuine issues of material fact surrounding the extent of Storms, McNamara, and Cline’s collaboration related to the subject matter claimed in the ’433 patent, Lancium’s Motion as to BearBox’s joint inventorship claim is denied.

### **C. Conversion**

#### **1. Statute of Limitations**

Lancium moves for summary judgment of BearBox’s conversion claim, arguing that the claim is barred by Louisiana’s one year statute of limitations. D.I. 149 at 30-33. Specifically, Lancium contends that BearBox’s currently pled conversion claim, which was brought with its Second Amended Complaint filed on February 16, 2022, falls outside the one-year prescriptive period because BearBox purportedly admits that it became aware of Lancium’s conversion on August 17, 2020, when BearBox reviewed the Lancium-Layer1 lawsuit. *Id.*; D.I. 195 at 18-19. Thus, Lancium argues that BearBox knew, or at a minimum, should have known, of Lancium’s conversion because the Lancium-Layer1 lawsuit explains Lancium’s method of arbitraging power to maximize profitability, which is allegedly identical to the conduct underlying the currently pled conversion claim. *See, e.g.*, D.I. 149 at 32; D.I. 195 at 18-19. Further, Lancium argues that BearBox’s operative conversion claim cannot benefit from the Original Complaint’s April 14, 2021 filing date (D.I. 1), thereby evading the one-year statute of limitations, because the currently pled conversion claim does not relate back to the originally pled conversion claim. *Id.*

BearBox vehemently disagrees. First, BearBox maintains that its conversion claim has been consistently pled as arising out of Lancium’s alleged deceptive inducement of BearBox’s

power arbitrage method under the guise of a potential business relationship through Storms and McNamara's communications in May 2019. D.I. 176 at 31. Thus, BearBox argues its currently pled conversion claim relates back to the date of the Original Complaint, thereby overcoming the statute of limitations. *Id.* at 31-32. Second, BearBox argues that, even if the currently pled conversion claim does not relate back to the Original Complaint, it is not barred by the one-year statute of limitations because BearBox did not learn of Lancium's theft of its specific energy arbitrage method until December 20, 2021, during Lancium's document production. *Id.* at 32-33. In support of this alternative argument, BearBox contends that the Lancium-Layer1 lawsuit does not even use the word "breakeven," and only explains "a high-level description of the bare concept of energy arbitrage" instead of disclosing, as Lancium contends, the particular arbitrage method at issue in this case. *Id.* In fact, BearBox asserts that Lancium's own expert, Dr. Siddiqui, opines that it is impossible to know how specific energy arbitrage methods are used without access to direct evidence of the actual arbitrage method. D.I. 176 at 33; D.I. 179, Ex. W at 34. Thus, BearBox argues that simply reading the Lancium-Layer1 lawsuit could not serve as actual or constructive knowledge sufficient to commence the one-year statute of limitations. *Id.*

Under Louisiana law,<sup>3</sup> "[a] conversion action sounds in tort and is subject to a one-year liberative prescriptive period." *Bihm v. Deca Sys., Inc.*, 226 So. 3d 466, 280 (La. App. 1st Cir. 2017) (citing LA. CIV. CODE ANN. art. 3492). Generally, the prescriptive period begins "to run from the day injury or damage is sustained." LA. CIV. CODE ANN. art. 3492. The injured party need not have actual knowledge of facts that would entitle him to bring a suit. *Bihm*, 226 So. 3d at 480 (citing *Gallant Investments, Ltd. v. Illinois Cent. R. Co.*, 7 So.3d 12, 19 (La. App. 1st Cir.

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<sup>3</sup> Neither party disputes that Louisiana law applies to BearBox's conversion claim. *See* D.I. 92 at 5 n.4.



2009)). Rather, notice sufficient “to excite attention and put the party on guard or call for inquiry”—referred to as constructive knowledge—can commence the prescriptive period. *Bihm*, 226 So. 3d at 480; *see also Hogg v. Chevron USA, Inc.*, 45 So.3d 991, 997 (La. 2010).

While claims brought outside the prescriptive period are generally barred, Louisiana explicitly grants amended claims that “relate back” to the original claim the benefit of the originally pleading’s filing date. *Clark v. E. Baton Rouge Par. Dep’t of Pub. Works*, 196 So. 3d 142, 146 (La. App. 1st Cir. 2016) (interpreting LA. CODE CIV. PROC. ANN. art. 1153); *see also Fed. R. Civ. P. 15(c)(1)* (an amendment relates back to the date of the original pleading if the “law that provides the applicable statute of limitations allows relation back.”). Pursuant to LA. CODE CIV. PROC. ANN. art. 1153, “an amendment to a [complaint] relates back to the date of filing the original [complaint] when the action or defense asserted in the amended [complaint] arises out of the conduct, transaction, or occurrence set forth or attempted to be set forth in the original pleading.” *Clark*, 196 So. 3d at 146. Courts are encouraged to apply the doctrine “liberally and without undue restriction by technical rules, consistent with the principle that prescriptive statutes are to be construed in favor of maintaining rather than barring actions.” *Id.*; *see also Winford v. Conerly Corp.*, 897 So.2d 560, 568 (La. 2015). As such, an amended complaint is not prescribed by the statute of limitations “[i]f a comparison of the amended petition to the original petition shows that the original petition gave fair notice of the factual situation out of which the amended petition arises.” *Clark*, 196 So. 3d at 146 (citing *Reese v. State Dep’t of Pub. Safety and Corrections*, 866 So.2d 244, 248 (La. 2004)).

A relation back analysis requires comparing the originally pled claim with the currently pled claim. *Clark*, 196 So. 3d at 146. BearBox’s original conversion claim sought recovery for “Defendants induc[ing] the Plaintiffs to disclose the BearBox Technology to them under the guise

of a possible business deal,” which allegedly began in May 2019 through a meeting between the two parties, followed by subsequent communications through email and text. *See* D.I. 1 at ¶¶ 3-4, 32-36. The Original Complaint defined “BearBox technology” as:

an energy-efficient cryptocurrency mining system and related methods that reduce the inefficiency and environmental impact of energy-expensive mining operations by better utilizing available energy resources to increase stability of the energy grid, minimize a mining operation’s impact on peak-demand, and also alleviate electricity undersupply and/or oversupply conditions . . . [which] can be used to mine cryptocurrency, such as Bitcoin.

D.I. 1 at ¶ 2. BearBox’s currently pled conversion claim seeks recovery for Lancium deceptively inducing BearBox to disclose BearBox’s “system designs, documents, data, and know-how” under the guise of a business deal in May 2019. D.I. 103 at ¶¶ 3, 89.

The factual connexity between the original conversion claim and the currently pled conversion claim is readily apparent on the face of the pleadings. Both claims seek recovery for the damages resulting from Lancium’s alleged deceptive conduct and theft in May 2019. *Compare* D.I. 1 at ¶¶ 32-36, *with* D.I. 103 at ¶ 89. While BearBox’s currently pled conversion claim expands on both the technology purportedly converted, i.e., “system designs, documents, data, and know-how,” and Lancium’s conduct after the alleged conversion, i.e., using such converted technology to modify Lancium’s Smart Response™ software, these amendments do not disturb the relation back doctrine because they only serve to elaborate on the facts supporting the underlying theory of conversion. D.I. 103 at ¶¶ 2, 87, 89. That is to say, the conduct supporting the original conversion claim is identical to the conduct supporting the currently pled conversion claim, regardless of the level of specificity the Second Amended Complaint provides. *Tiller v. Atl. Coast Line R. Co.*, 323 U.S. 574, 581 (1945) (the original pleading and the amended pleading “relate to the same general conduct . . . the cause of action now, as it was in the beginning, is the same.”).



Furthermore, the Court is not persuaded by Lancium's assertion that BearBox's own admissions are fatal to finding that the currently pled conversion claim relates back to the original claim. D.I. 149 at 33. As an initial matter, Lancium's selective citation to BearBox's counsel's statement that the Original Complaint "had nothing to do with energy value arbitrage methods" omits a key consideration—BearBox's counsel was distinguishing between the first Complaint's underlying trade secret, i.e., system architecture, and the proposed amendment supporting BearBox's new trade secret claims. *See* D.I. 151, Ex. 22 at 22:16-24:6. And even if BearBox counsel's characterization of the facts underlying each complaint differ, Lancium's conclusion ignores that the conduct underlying the currently pled conversion claim is identical to the conduct pled in the original conversion claim—the deceptive inducement of BearBox's methods and systems through Storms and McNamara's May 2019 communications. Such a rigid comparison of the two conversion claims, as Lancium proffers, is contrary to the general principle that LA. CODE CIV. PROC. ANN. art. 1153 should be liberally construed to do substantial justice. *Reese*, 866 So.2d at 249. As such, the original conversion claim was sufficient to put Lancium on notice that BearBox was seeking recovery for conversion of its technology in May 2019. The currently pled conversion claim created no surprise or prejudice to Lancium, and merely clarified the facts supporting its theory of conversion, including the specific property converted and Lancium's incorporation of the converted property into its Smart Response™ software—all facts which BearBox contends were only brought to light during discovery, which led BearBox to promptly amend its conversion claim. *See* D.I. 176 at 31.

BearBox's currently pled conversion claim can therefore benefit from the Original Complaint's April 14, 2021 filing date. Therefore, it follows that BearBox's currently pled conversion claim was brought within the prescribed one-year statute of limitations. Because the



Court finds that the currently pled conversion claim was brought within the prescribed one-year statute of limitations, the Court need not address Lancium's argument that BearBox knew, or should have known, of the alleged conversion based on BearBox's August 17, 2020 review of the Lancium-Layer1 lawsuit.

## 2. Preemption Under Federal Patent Law

Separately, Lancium moves for summary judgment of BearBox's conversion claim on the ground that the conversion claim is preempted by federal patent law. *See* D.I. 149 at 33-36. The Court agrees.

Under the Supremacy Clause, state law that conflicts with federal law is without effect. U.S. Const. art. VI, cl. 2; *see, e.g., Bonito Boats v. Thunder Craft Boats*, 489 U.S. 141, 168 (1989); *Hunter Douglas, Inc. v. Harmonic Design, Inc.*, 153 F.3d 1318, 1331 (Fed. Cir. 1998), *overruled in part on other grounds by Midwest Indus. v. Karavan Trailers, Inc.*, 175 F.3d 1356 (Fed. Cir. 1999). Preemption can take one of three unique forms: explicit, field, or conflict preemption. *See Hunter Douglas*, 153 F.3d at 1332. Because federal patent law does not provide explicit preemption, *see, e.g., 35 U.S.C. §§ 1–376; Hunter Douglas*, 153 F.3d at 1332, and because Congress does not intend to exclusively occupy the field of conversion law, this case solely concerns conflict preemption. Conflict preemption occurs when state law “stands as an obstacle to the accomplishment and execution of the full purposes and objectives of Congress.” *Aronson v. Quick Point Pencil Co.*, 440 U.S. 257, 262 (1979) (quoting *Hines v. Davidowitz*, 312 U.S. 52, 67 (1941)) (internal quotations omitted).

Federal law preempts state law that offers “patent-like protection” to discoveries unprotected under federal patent law. *Bonito Boats*, 489 U.S. at 156. Federal patent law reflects the objectives of Congress, which includes: (1) “seek[ing] to foster and reward invention”; (2) “promot[ing] disclosure of inventions to stimulate further innovation and to permit the public to

practice the invention once the patent expires”; (3) promoting “the stringent requirements for patent protection . . . to assure that ideas in the public domain remain there for the free use of the public,” *Aronson*, 440 U.S. at 262 (citing *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 480-81 (1974)); (4) providing a “clear federal demarcation between public and private property”; and (5) promoting “nationwide uniformity in patent law.” *Bonito Boats*, 489 U.S. at 162-63. A state cause of action that frustrates these objectives is preempted. *Id.* at 156-57; *Aronson*, 440 U.S. at 262.

In the specific context of a conversion claim, courts have differentiated between claims that are dependent on a determination of patent inventorship or ownership and those that are based on a non-patent theory of conversion. Claims that are dependent on a determination of patent inventorship or ownership, such as a misappropriation of patent rights, are generally preempted by federal patent law. *See Smith v. Healy*, 744 F. Supp. 2d 1112, 1130 (D. Or. 2010) (“Plaintiffs’ proposed conversion claim does not concern Plaintiffs’ tangible property but rather their intangible idea . . . therefore . . . Plaintiffs’ proposed conversion claim would be preempted by [federal] patent law.”). In contrast, claims that can be established without reference to patent inventorship or ownership are generally not preempted by federal patent law. *See HIF Bio, Inc. v. Yung Shin Pharms. Industrial Co.*, 600 F.3d 1347, 1354 (Fed. Cir. 2010) (suggesting that plaintiffs could establish a conversion claim not preempted by federal law by basing their claim on defendants’ alleged misappropriation of experiments, experimental data, and non-public drafts of papers).

BearBox’s conversion claim begins by incorporating by reference the allegations from BearBox’s correction of inventorship claims. D.I. 103 at ¶ 84. BearBox then explains how Lancium’s “unlawful exercise of dominion over confidential BearBox technology, including system designs, documents, data, and know-how not otherwise found to be a trade secret, or having value beyond the value of the trade secret(s), has permanently interfered with [BearBox’s] valuable



property rights.” D.I. 103 at ¶ 88. Finally, BearBox outlines that it “[has] suffered and will continue to suffer damages and other financial harms” because Lancium “[has] not compensated or recognized [BearBox] for the use of BearBox’s technology.” D.I. 103 at ¶¶ 89-90.

By its wording, it is clear that BearBox’s conversion claim is “patent-like” in nature and also turns on a determination of inventorship regarding the subject matter of the ’433 patent. *See Smith*, 744 F. Supp. 2d at 1130. Although conversion under Louisiana law does not necessarily implicate patent law, the theory underlying BearBox’s conversion claim—the theft of BearBox’s system designs, documents, data, and know-how which was integrated and monetized by Lancium through its Smart Response™ software, without compensating or recognizing BearBox—seeks protection and remedial compensation for the alleged misappropriation of BearBox’s novel ideas. D.I. 103 at ¶ 89. In other words, BearBox’s claim that Lancium “has permanently interfered with [BearBox’s] valuable property rights” by misappropriating BearBox’s technology is a second bite of the apple to correct inventorship if the Court were to find that Storms is neither a sole nor joint inventor of the ’433 patent.

BearBox’s attempt to differentiate its conversion claim as relying on a non-patent theory of recovery is unsuccessful. While the Court recognizes that BearBox amended its pleading to allege that “[n]ot all aspects of BearBox’s technology that was stolen and used by Defendants was described and claimed in the ’433 Patent,” *see* D.I. 103 at ¶ 46, this allegation cannot serve as the basis for a non-patent theory of recovery. This is because BearBox’s own expert, Dr. McClellan, concedes that regardless of whether the ’433 patent actually discloses BearBox’s power arbitrage method, BearBox is barred from using its power arbitrage method because it may likely infringe the ’433 patent. *See* D.I. 196-1, Ex. 30 at 231:10-232:1. Stated another way, the alleged converted property is described and disclosed in the ’433 patent. *See id.* at 231:18-232:1 (“If [Storms] were

to use his [power arbitrage method], it might be infringing the ['433] patent anyway. Even if he used his system—because the arbitrage adds onto the capabilities disclosed in the patent. It adds some things onto that aren't specifically disclosed in the patent, but they're hinted at. . . . even if you implemented a system like this, . . . you may end up infringing the patent regardless.”). Further, BearBox’s attempt to reconcile its conversion claim as a non-patent theory of recovery is further belied by its own arguments and headings in its Answering Brief. For example, BearBox’s heading stating that “Lancium filed the '433 patent to monopolize Storms’ portions of the system that Storms communicated to it,” *see* D.I. 176 at 12, supports the reasonable conclusion that all the communications sent to Lancium served as the foundation for the '433 patent. This contradicts BearBox’s own assertion that not everything communicated, and therefore converted, served as the basis for the '433 patent. *See* D.I. 103 at ¶ 46. The Court’s conclusion is also supported by the fact that BearBox’s conversion claim begins by incorporating by reference its inventorship claims. D.I. 103 at 84.

That BearBox’s conversion claim seeks to recover patent-like damages further supports that it is preempted by federal patent law. There is no dispute that, under Louisiana law, “[t]he measure of damages for wrongful conversion is the return of the property, or if it cannot be returned, the value of the property at the time of conversion.” *Capers v. NorthPro Properties Mgmt, LLC*, 321 So. 3d 502, 514 (La. App. 2d Cir. 2021). However, rather than solely demand the return of its allegedly converted property, BearBox repeatedly pursues monetary damages akin to a royalty-like payment. D.I. 103 at ¶¶ 6, 89, “Prayer for Relief” at ¶ G. BearBox’s Second Amended Complaint is also replete with assertions advancing the theme that BearBox is entitled to monetary damages because of Lancium’s purported failure to compensate or recognize BearBox for the use of BearBox’s converted technology. *See, e.g., id.* at ¶ 6 (“Plaintiffs bring this action to

recover damages caused by Defendants' theft and unauthorized use, and subsequent exploitation of Plaintiffs system design, data, documents, and know-how."); *id.* at ¶ 50 ("Defendants have used BearBox's technology, including the stolen system designs, diagrams, data, and know-how, and its subsequently-modified Smart Response™ software . . . to allow Defendants to profit significantly from use, license, sale, and investments related to its modified Smart Response™ software. ***Defendants are not, and have never, been entitled to these profits.***") (emphasis added); *id.* at ¶ 87 ("Without Plaintiffs' consent, Defendants intentionally and willfully assume dominion and control over BearBox's technology, including system designs, documents, data, and know-how, and improperly used it to modify their Smart Response™ software . . . and subsequently used, sold, licensed, and procured investments related to, and otherwise monetized, that software for substantial profit."); *id.* at ¶ 89 ("Despite providing Defendants with the system designs, documents, data, and know-how that allowed Defendants to modify their Smart Response™ software, and corresponding system designs, ***Defendants have not compensated or recognized Plaintiffs for the use of BearBox's technology.*** Defendants' actions constitute an improper and unauthorized use of Plaintiffs' property.") (emphasis added); *id.* at 90 ("As a result of Defendants' improper and unauthorized use of Plaintiffs' system designs, documents, data, and know-how to reconstruct and use BearBox's technology, Plaintiffs ***have suffered and will continue to suffer damages and other financial harms*** in an amount to be proven at trial.") (emphasis added).

By these allegations' wording, it is clear that BearBox's damages are predicated on the resolution of inventorship or ownership of the technology disclosed in the '433 patent. That BearBox seeks patent-like damages is further supported by BearBox's own damages expert, David Duski, who both reaffirms that BearBox seeks monetary damages in, effectively, a repackaged form of a royalty payment, and reasserts BearBox's theme that monetary damages are necessary



to compensate or recognize BearBox for use of BearBox’s converted technology. D.I. 170, Ex. 25 at 8 (“[T]he value of the Converted Property may be determined by calculating the present value of the future cash flows Lancium expected to receive attributable to the Converted Property at the time of conversion.”); *id.* at 14 (“I understand that through the use of the Converted Property, Lancium will be able to craft voluntary reduction and/or bid strategies that ensure maximum profits.”); *see, e.g., Speedfit LLC v. Woodway USA, Inc.*, 226 F. Supp. 3d 149, 160 (E.D.N.Y. 2016) (concluding that the plaintiffs’ conversion claim was preempted by federal patent law, where plaintiffs’ underlying conversion claim sought royalty-like damages that ultimately required a determination of inventorship). Therefore, considering the totality of evidence, BearBox’s conversion claim is preempted by federal patent law because the right involved here and compensated for relies on a theory of conversion that is “patent-like” in nature. Lancium’s Motion related to BearBox’s conversion claim being preempted by federal patent law is granted, and BearBox’s conversion claim (Count V) is dismissed with prejudice.

#### **IV. LANCIMUM’S PENDING MOTIONS**

In addition to Lancium’s First Motion for Summary Judgment (D.I. 148), Lancium also filed a Second Motion for Summary Judgment Regarding Damages combined with a Motion to Exclude Opinions of David Duski (D.I. 167), and a Motion to Bifurcate BearBox’s Patent Inventorship Claims from the Conversion Claims (D.I. 222) (collectively, “Lancium’s Pending Motions”). However, as both of Lancium’s Pending Motions solely depend on BearBox’s conversion claim—which has now been dismissed with prejudice—the Court will deny Lancium’s Pending Motions as moot.

The Court will issue an order consistent with this Memorandum Opinion.

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

BEARBOX LLC and AUSTIN STORMS,

Plaintiffs,

v.

LANCIUM LLC, MICHAEL T.  
MCNAMARA, and RAYMOND E.  
CLINE, JR.,

Defendants.

Civil Action No. 21-534-GBW

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**ORDER**

At Wilmington this 14th day of November, 2022:

For the reasons set forth in the Memorandum Opinion issued this day, **IT IS HEREBY ORDERED** that:

1. Lancium's First Motion for Summary Judgment (D.I. 148) is **GRANTED-IN-PART** and **DENIED-IN-PART**;
2. Count V of BearBox's Second Amended Complaint (D.I. 103) is **DISMISSED WITH PREJUDICE**;
3. Lancium's Second Motion for Summary Judgment Regarding Damages and Motion to Exclude Opinions of David Duski (D.I. 167) is **DENIED AS MOOT**; and
4. Lancium's Motion to Bifurcate BearBox's Patent Inventorship Claims from the Conversion Claims (D.I. 222) is **DENIED AS MOOT**.

Because the Memorandum Opinion is filed under seal, the parties shall meet and confer and, no later than November 23, 2022, submit a joint proposed redacted version, accompanied by a supporting memorandum, detailing how, under applicable law, the Court may approve any

requested redactions. In the absence of a timely, compliant request, the Court will unseal the entire opinion.



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GREGORY B. WILLIAMS  
UNITED STATES DISTRICT JUDGE



IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

BEARBOX LLC and AUSTIN STORMS,

Plaintiffs,

v.

LANCIUM LLC, MICHAEL T.  
MCNAMARA, and RAYMOND E.  
CLINE, JR.,

Defendants.

C.A. No. 21-534-GBW

**FILED UNDER SEAL**

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**MEMORANDUM ORDER**

At Wilmington, Delaware this 23rd day of November 2022.

Having reviewed the parties' letter briefing and other materials filed with respect to Defendants Lancium LLC, Michael T. McNamara, and Raymond E. Cline, Jr.'s (collectively, "Lancium") Motion to Strike Plaintiffs BearBox LLC and Austin Storms's (collectively, "BearBox") Supplemental Expert Report of Dr. Stanley McClellan ("Dr. McClellan's Supplemental Report"), IT IS HEREBY ORDERED that Lancium's Motion to Strike (D.I. 236) is **GRANTED** and Dr. McClellan's Supplemental Report is **STRICKEN**.

The Court recognizes that the exclusion of otherwise admissible testimony because of a party's failure to meet a timing requirement is a harsh measure and should be avoided where possible. *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 792 (3d Cir. 1994). "However, sometimes, such exclusion is necessary; fidelity to the constraints of Scheduling Orders and deadlines is critical to the Court's case management responsibilities," because "flouting of discovery deadlines causes substantial harm to the judicial system." *Finch v. Hercules, Inc.*, 1995 WL 785100, at \*9 (D .Del. 1995) (internal citations omitted). As a sanction for failure to comply



with the Scheduling Order, the Court has the authority to sanction a party by “prohibiting that party from introducing designated matters in evidence.” Fed. R. Civ. P. 37(b).

Courts in the Third Circuit apply the *Pennypack* factors when considering whether to strike an expert report. *See Praxair, Inc. v. ATMI, Inc.*, 231 F.R.D. 457 (D. Del. 2005), *rev’d on other grounds*, 543 F.3d 1306 (Fed. Cir. 2008). The *Pennypack* factors are as follows:

(1) the prejudice or surprise in fact of the party against whom the evidence would have been presented, (2) the ability of that party to cure the prejudice, (3) the extent to which the presentation of the evidence would disrupt the orderly and efficient trial of the case or other cases in the court, (4) bad faith or willfulness in failing to comply with the court’s order, and (5) the importance of the excluded evidence.

*LabMD Inc. v. Boback*, 47 F.4th 164, 189 (3d Cir. 2022).

Here, the weight of the *Pennypack* factors favor excluding Dr. McClellan’s Supplemental Report. At the outset, comparing both Dr. McClellan’s Opening Report, *see* D.I. 151-1, Ex. 3, and his Reply Report, *see id.* at Ex. 4, with Dr. McClellan’s Supplemental Report, it is clear that Dr. McClellan is offering new legal theories and opinions related to BearBox’s alleged conception and communication of the subject matter of the ’433 patent. For example, Dr. McClellan’s Supplement Report offers an analysis of how Austin Storms allegedly conceived of a system where the power entity held the option. *See* D.I. 237, Ex. 1 at ¶¶ 25-26. However, Dr. McClellan was previously of the opinion that the load, not the power entity, held the option in a power option agreement. *See* McClellan Dep. Tr. at 157:1-18 (testifying that the plain and ordinary meaning of “power option agreement” is “opting to purchase power ahead of time at a certain rate . . . I’m going to pay for that power, that’s the option.”). Although Dr. McClellan contends that his understanding of the claim terms is consistent with the Court’s adopted construction, *see* D.I. 237, Ex. 1 at ¶ 6, this subtle distinction supplies the justification Dr. McClellan relies upon when advancing the new

theory that the “power entity associated with the delivery of power to a load” is depicted as “generation assets” in the diagram communicated by BearBox to Lancium. *See id.* at ¶¶ 25-26.

Further, Dr. McClellan offers a new opinion related to “minimum power threshold” and what is required of the load. *See id.* at ¶¶ 24-26. Specifically, Dr. McClellan’s Supplemental Report now applies “consume” and “use” interchangeably—although he previously opined that a load was not required to use the “minimum power threshold,” *see* D.I. 151, Ex. 5 at 84:18-85:1—and further states that BearBox’s system “was designed for the miners to receive instructions to consume, or use, a fixed amount of energy by mining Bitcoin” unless otherwise instructed. *See* D.I. 237, Ex. 1 at ¶¶ 25-26. But, neither Dr. McClellan’s Opening Report nor his Reply Report explain how BearBox’s system operated by maintaining “a minimum amount of power a load must use during an associated time interval” (i.e., “minimum power threshold”) as defined by the power option agreement. While a comparison of an expert’s reports does not require “verbatim consistency,” *see Dow Chem. Co. v. Nova Chemicals Corp. (Canada)*, 2010 WL 2044931, at \*2 (D. Del. May 20, 2010) (quoting *Power Integrations, Inc. v. Fairchild Semiconductor Int’l, Inc.*, 585 F. Supp. 2d 568, 581 (D. Del. 2008)), Dr. McClellan’s opinions in his Supplemental Report are beyond mere “elaboration” or “clarification.” Instead, Dr. McClellan advances untimely new legal theories and opinions which would ultimately prejudice Lancium, especially at this late juncture of the case.<sup>1</sup>

Beyond offering new opinions, Dr. McClellan’s Supplemental Report is untimely. The Court’s Scheduling Order requires opening expert reports to be served on April 5, 2022, rebuttal

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<sup>1</sup> Even assuming that BearBox was correct that Dr. McClellan’s Supplemental Report does not offer new opinions, the Court cannot reasonably conclude that exclusion of that report—which would necessarily reiterate the same opinions proffered in Dr. McClellan’s Opening Report and Reply Report—would harm BearBox.



reports be served by May 6, 2022, and reply reports be served by May 20, 2022. *See* D.I. 35. The parties stipulated to extending the expert discovery deadline, which ultimately closed on June 6, 2022. D.I. 109. But it was not until November 11, 2022, nearly three weeks before the start of a three day bench trial, that Dr. McClellan filed his Supplemental Report. *See* D.I. 237 at Ex. 2, Ex. 3. What is more, in contravention of the Court’s Scheduling Order, BearBox neither sought leave of the Court or consent from Lancium to serve Dr. McClellan’s Supplemental Report. *See id.* at ¶ 7(f)(i) (“No other expert reports will be permitted without either the consent of all parties or leave of the Court.”). BearBox’s disregard of the express terms of the Court’s Scheduling Order indicates bad faith which weighs in favor of exclusion. *See, e.g., Praxair*, 231 F.R.D. at 463-64; *Masimo Corp. v. Philips Elec. North Am. Corp.*, 2013 WL 2178047, at \*11-13 (D. Del. May 20, 2013) (recommending striking untimely supplemental expert report), *recommendation adopted by Masimo Corp. v. Philips Elec. North Am. Corp.*, 62 F. Supp. 3d 368, 388-389 (D. Del. 2014).

Additionally, BearBox’s proffered excuse that its delay in serving Dr. McClellan’s Supplemental Report is the creation of Lancium’s untimely request for claim construction is meritless. *See* D.I. 241 at 1-3. Contrary to BearBox’s assertion, applying or analyzing the “plain and ordinary” meaning of the disputed terms was evident to BearBox by at least May 2022, when Lancium’s expert—Dr. Ehsani—applied the “plain and ordinary” meaning in his rebuttal expert report. *See Praxair*, 231 F.R.D. at 463-64 (excluding defendants’ supplemental expert report in part because defendants were aware of plaintiff’s differing opinion “months ago when the expert reports were filed.”); *see* D.I. 154, Ex. A at ¶¶ 42-43, 107, 109, 116-117. That the Court only recently adopted Lancium’s proposed “plain and ordinary” meaning of the disputed terms as the proper construction does not alter the fact that both BearBox and Dr. McClellan were equipped with Lancium’s proposed constructions six months prior to supplementing Dr. McClellan’s

reports. In fact, Dr. McClellan had an obligation to address Lancium's arguments and analysis related to the plain and ordinary meaning of these disputed terms. *See, e.g., St. Clair Intellectual Prop. Consultants, Inc. v. Matsushita Elec. Indus. Co., Ltd.*, 2012 WL 1015993, at \*5 (D. Del. Mar. 26, 2012) ("When claim construction remains an open issue at the time the parties serve expert reports . . . the parties have an obligation 'to prepare for the fact that the court may adopt [the other party's claim] construction.'" (quoting *Union Carbide Chems. & Plastics Tech. Corp. v. Shell Oil Co.*, 270 F. Supp. 2d 519, 524 (D. Del. 2003))). Even more, Dr. McClellan acknowledged that he and Lancium's expert disagreed on the plain and ordinary meaning of the disputed terms, *see* D.I. 151, Ex. 4 at ¶ 86, yet failed to apply or analyze what Lancium's expert considered to be the "plain and ordinary" meaning. *Id.* at ¶ 8.

Finally, because Dr. McClellan's Supplement Report was served on November 11, 2022, and a three day bench trial is set to begin on December 6, 2022, Lancium has no meaningful opportunity to conduct rebuttal discovery, prepare a supplemental rebuttal report, or prepare for an additional deposition. *See, e.g., Praxair*, 231 F.R.D. at 463-64; *Masimo Corp.*, 2013 WL 2178047, at \*12; *INVISTA North America S.a.r.l. v. M&G USA Corp.*, 2013 WL 3216109, at \*3-4 (D. Del. June 25, 2013). While BearBox's offer to have Dr. Ehsani provide a supplemental report to address Dr. McClellan's Supplemental Report may cure some prejudice, *see* D.I. 243 at 2 n.4, this would undoubtedly disrupt the trial process. Moreover, in light of the approaching Thanksgiving holiday, such a strained schedule exacerbates the potential prejudice.

The risk of prejudice suffered by Lancium is uncurable in light of the strained schedule and quickly approaching trial. Therefore, because the *Pennypack* factors favor exclusion of Dr. McClellan's Supplemental Report, Lancium's Motion to Strike is granted.



WHEREFORE, at Wilmington this 23rd day of November, 2022, **IT IS HEREBY ORDERED** that Lancium's Motion to Strike (D.I. 236) is **GRANTED**, and BearBox's Supplemental Expert Report of Dr. McClellan is **STRICKEN**.

Because the Memorandum Order is filed under seal, the parties shall meet and confer and, no later than November 29, 2022, submit a joint proposed redacted version, accompanied by a supporting memorandum, detailing how, under applicable law, the Court may approve any requested redactions. In the absence of a timely, compliant request, the Court will unseal the entire order.

A handwritten signature in black ink, appearing to read 'G. B. Williams', is written over a horizontal line.

GREGORY B. WILLIAMS  
UNITED STATES DISTRICT JUDGE







US010608433B1

(12) **United States Patent**  
**McNamara et al.**

(10) **Patent No.:** **US 10,608,433 B1**

(45) **Date of Patent:** **Mar. 31, 2020**

(54) **METHODS AND SYSTEMS FOR ADJUSTING POWER CONSUMPTION BASED ON A FIXED-DURATION POWER OPTION AGREEMENT**

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(73) Assignee: **Lancium LLC**, Houston, TX (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/702,931**

(22) Filed: **Dec. 4, 2019**

#### Related U.S. Application Data

(60) Provisional application No. 62/927,119, filed on Oct. 28, 2019.

(51) **Int. Cl.**  
**H02J 3/14** (2006.01)  
**H02J 3/00** (2006.01)  
**G06F 1/3203** (2019.01)

(52) **U.S. Cl.**  
CPC ..... **H02J 3/14** (2013.01); **G06F 1/3203** (2013.01); **H02J 3/008** (2013.01)

(58) **Field of Classification Search**  
CPC ..... H02J 3/14; H02J 3/008; G06F 1/3203  
See application file for complete search history.

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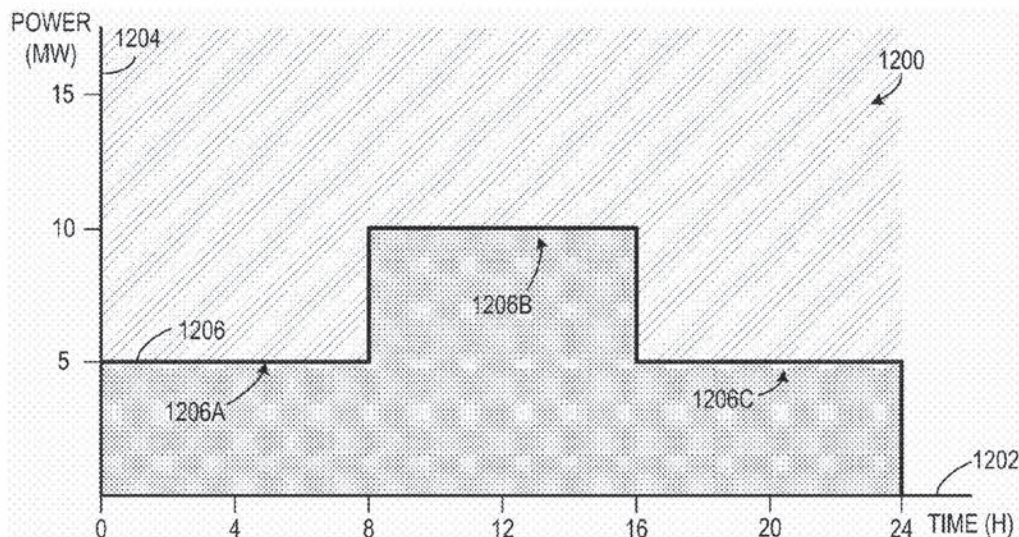
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#### (57) ABSTRACT

Examples relate to adjusting load power consumption based on a power option agreement. A computing system may receive power option data that is based on a power option agreement and specify minimum power thresholds associated with time intervals. The computing system may determine a performance strategy for a load (e.g., set of computing systems) based on a combination of the power option data and one or more monitored conditions. The performance strategy may specify a power consumption target for the load for each time interval such that each power consumption target is equal to or greater than the minimum power threshold associated with each time interval. The computing system may provide instructions the set of computing systems to perform one or more computational operations based on the performance strategy.

**20 Claims, 16 Drawing Sheets**





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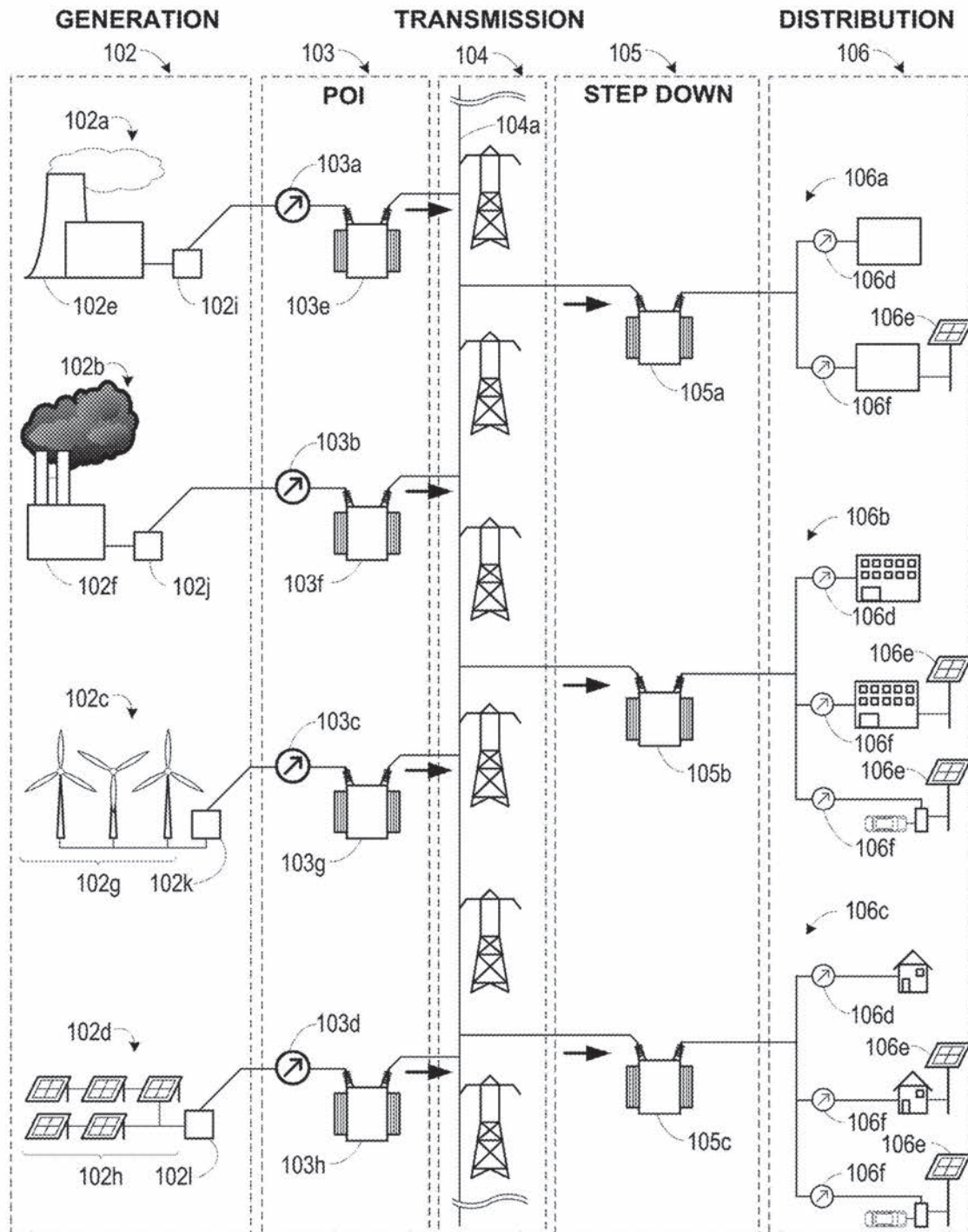


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PRIOR ART  
FIGURE 1

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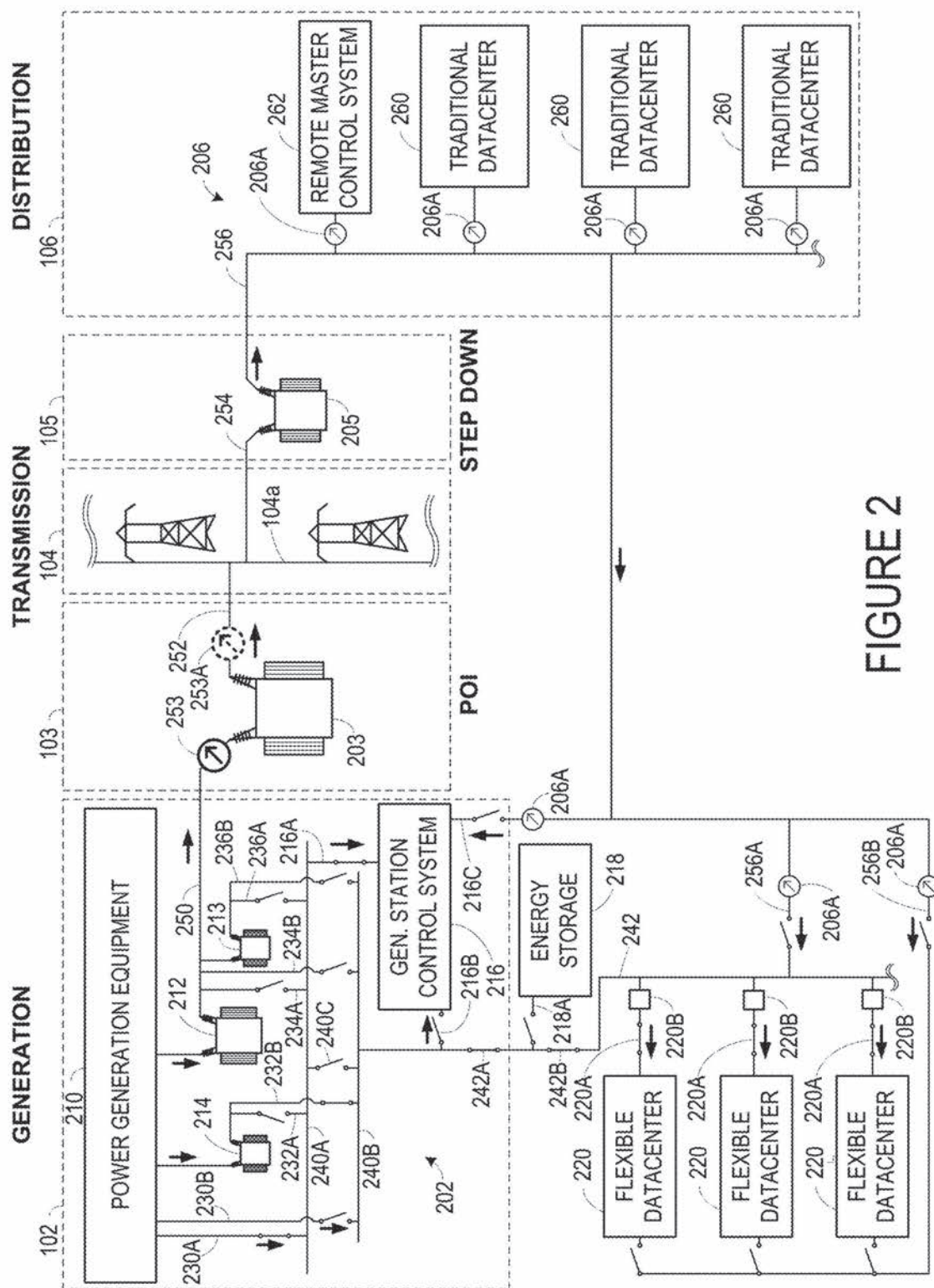


FIGURE 2

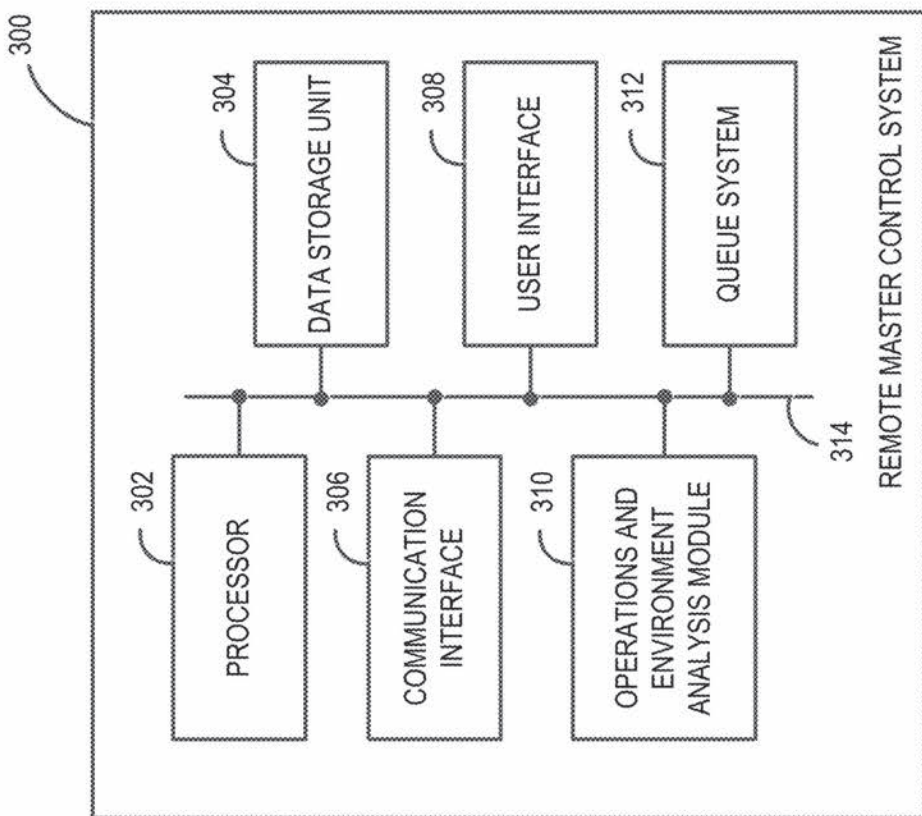


FIGURE 3

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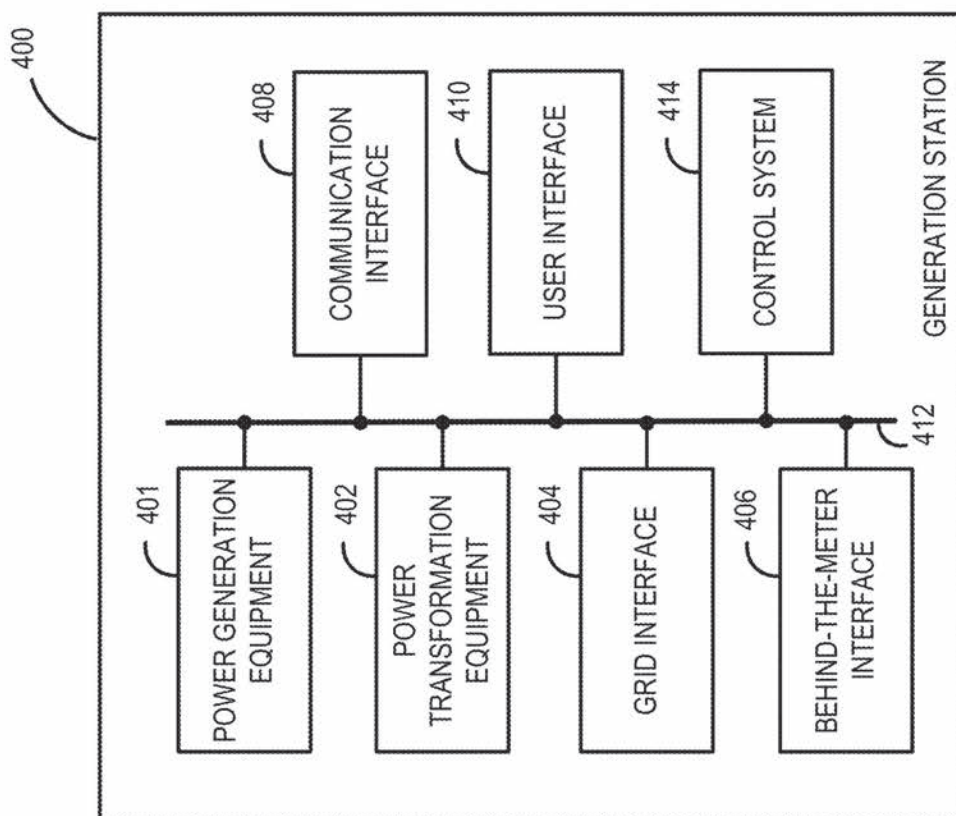


FIGURE 4



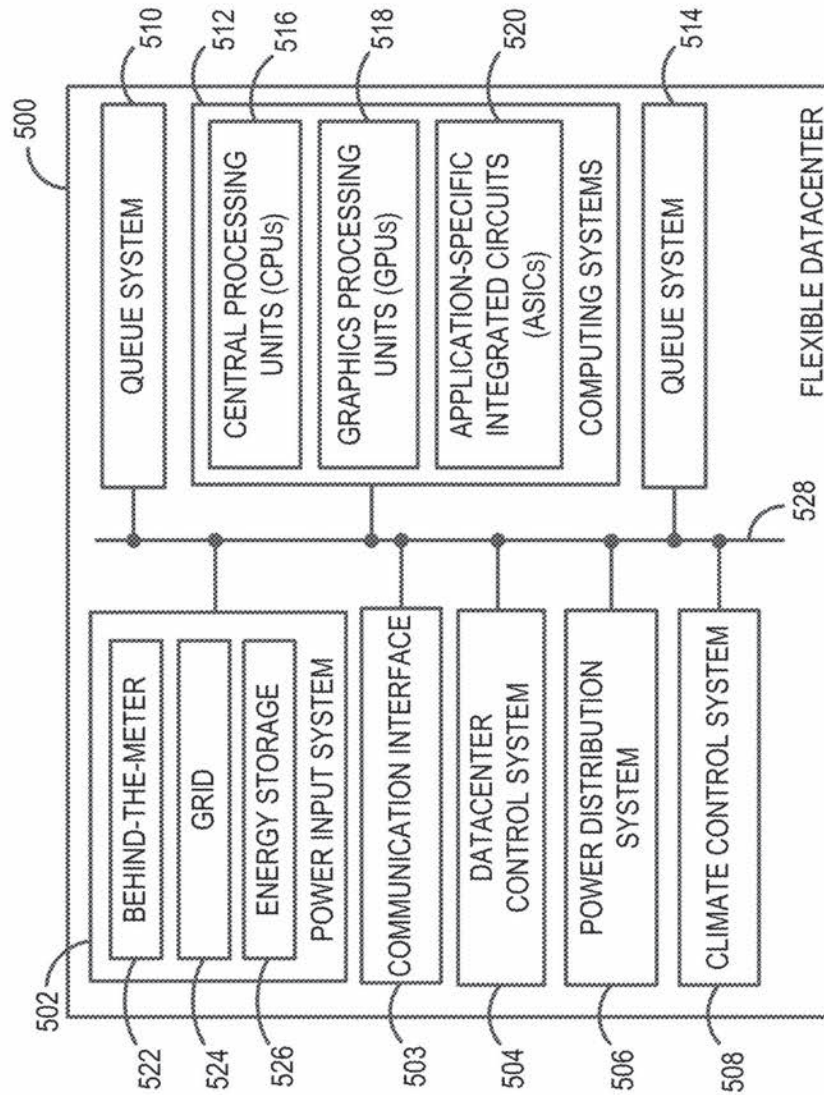


FIGURE 5

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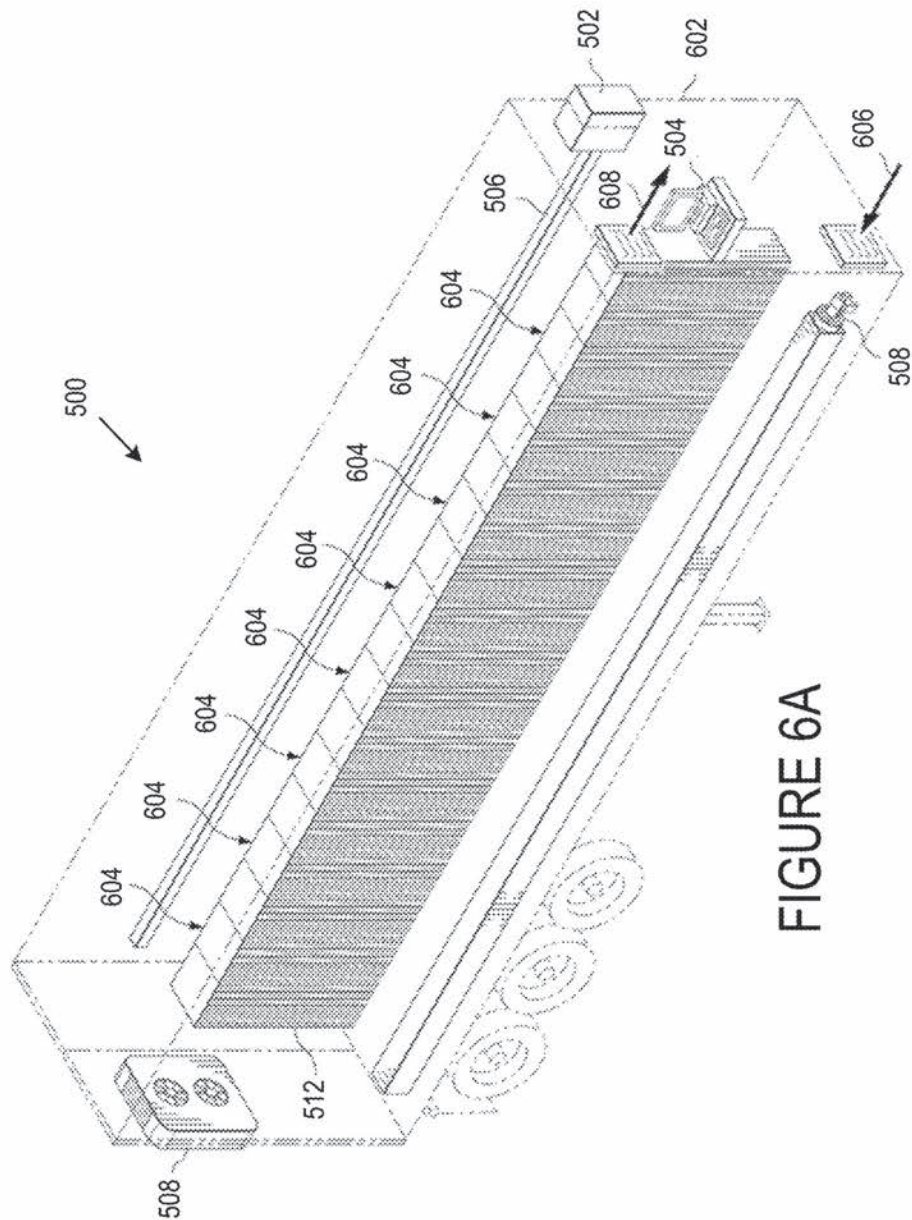


FIGURE 6A

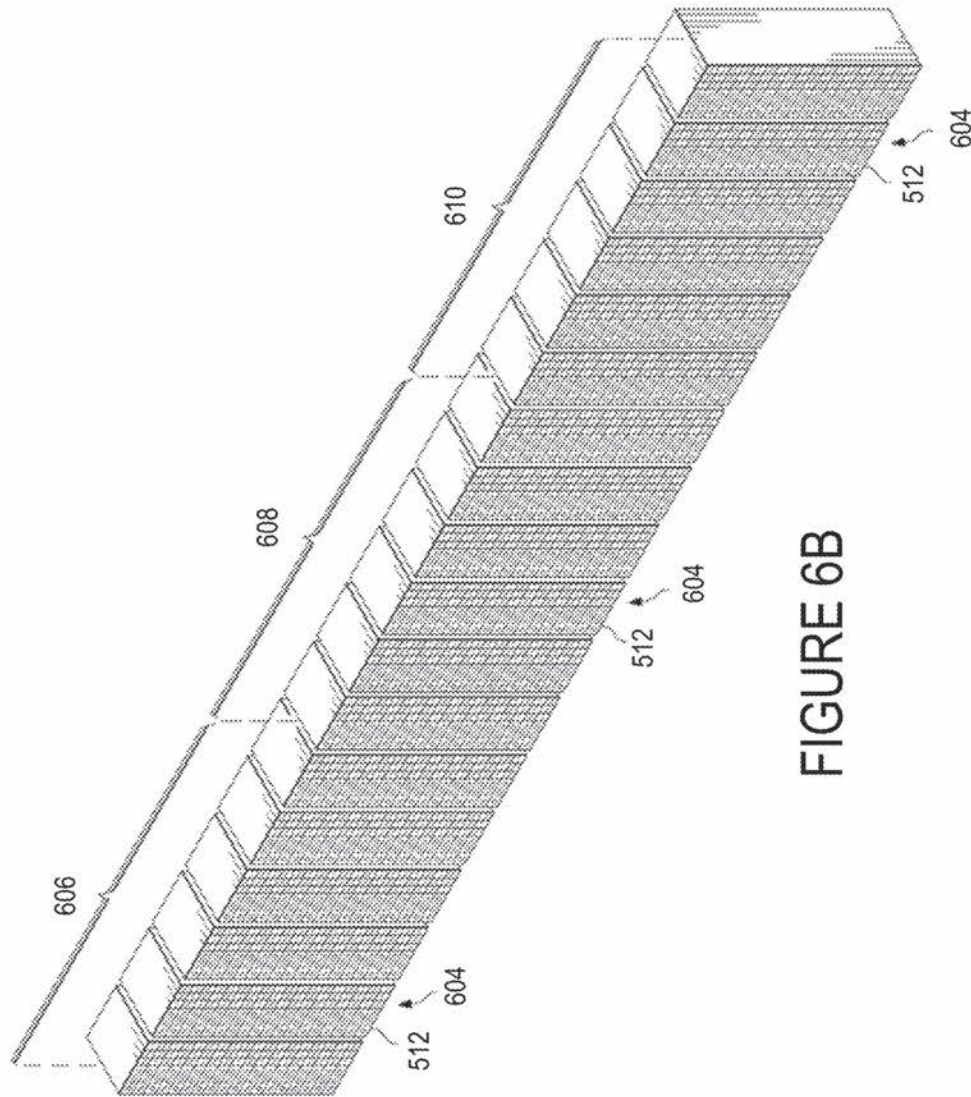


FIGURE 6B

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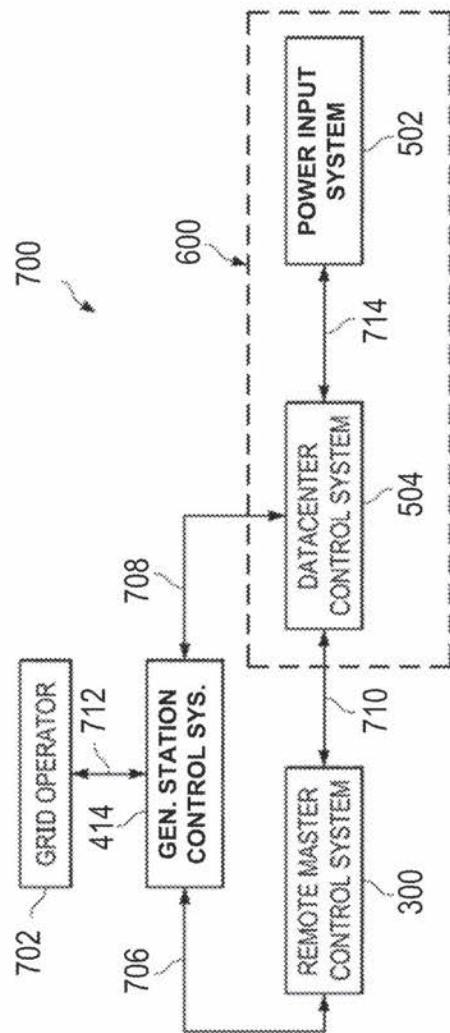


FIGURE 7



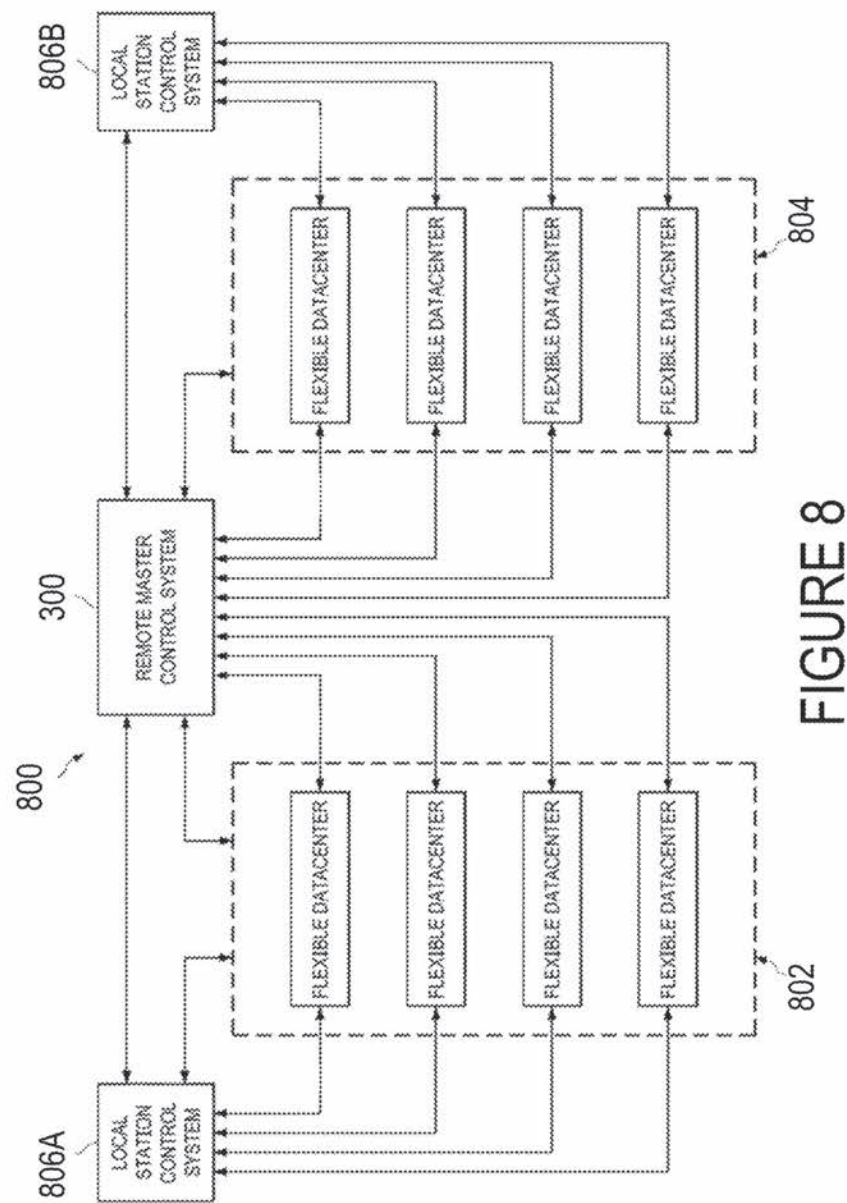


FIGURE 8

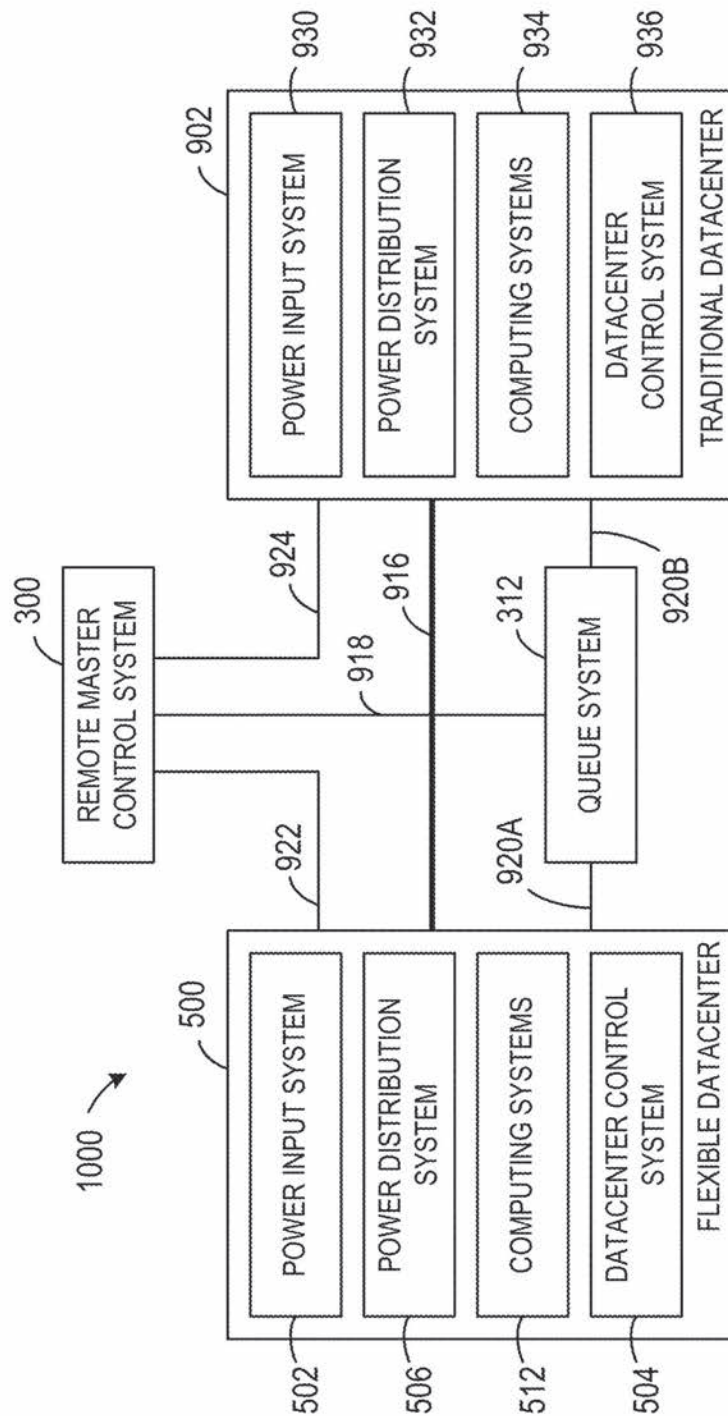


FIGURE 9

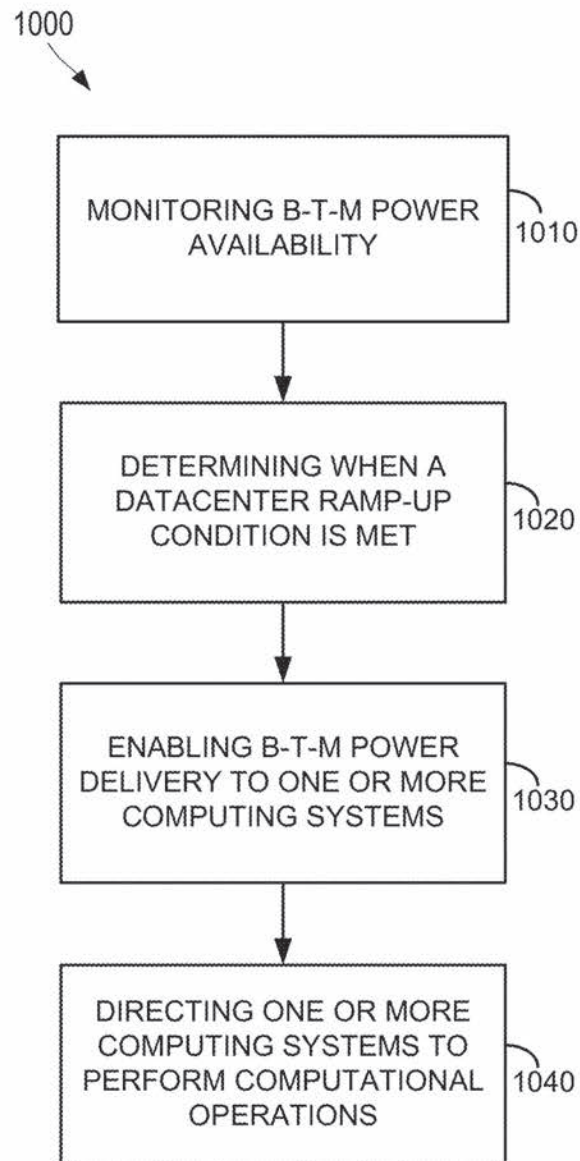


FIGURE 10A

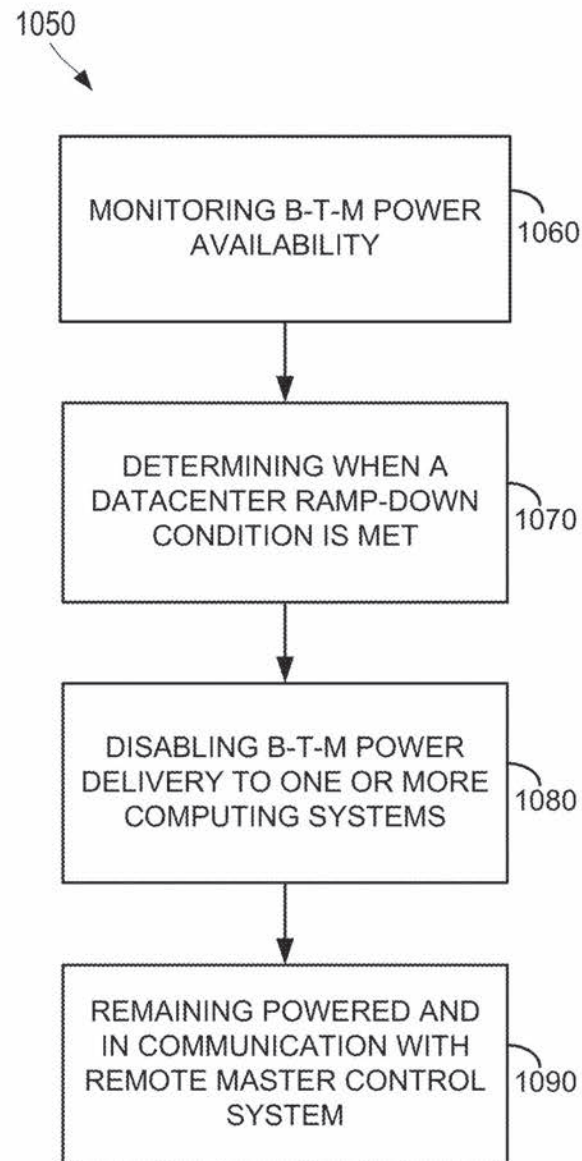


FIGURE 10B



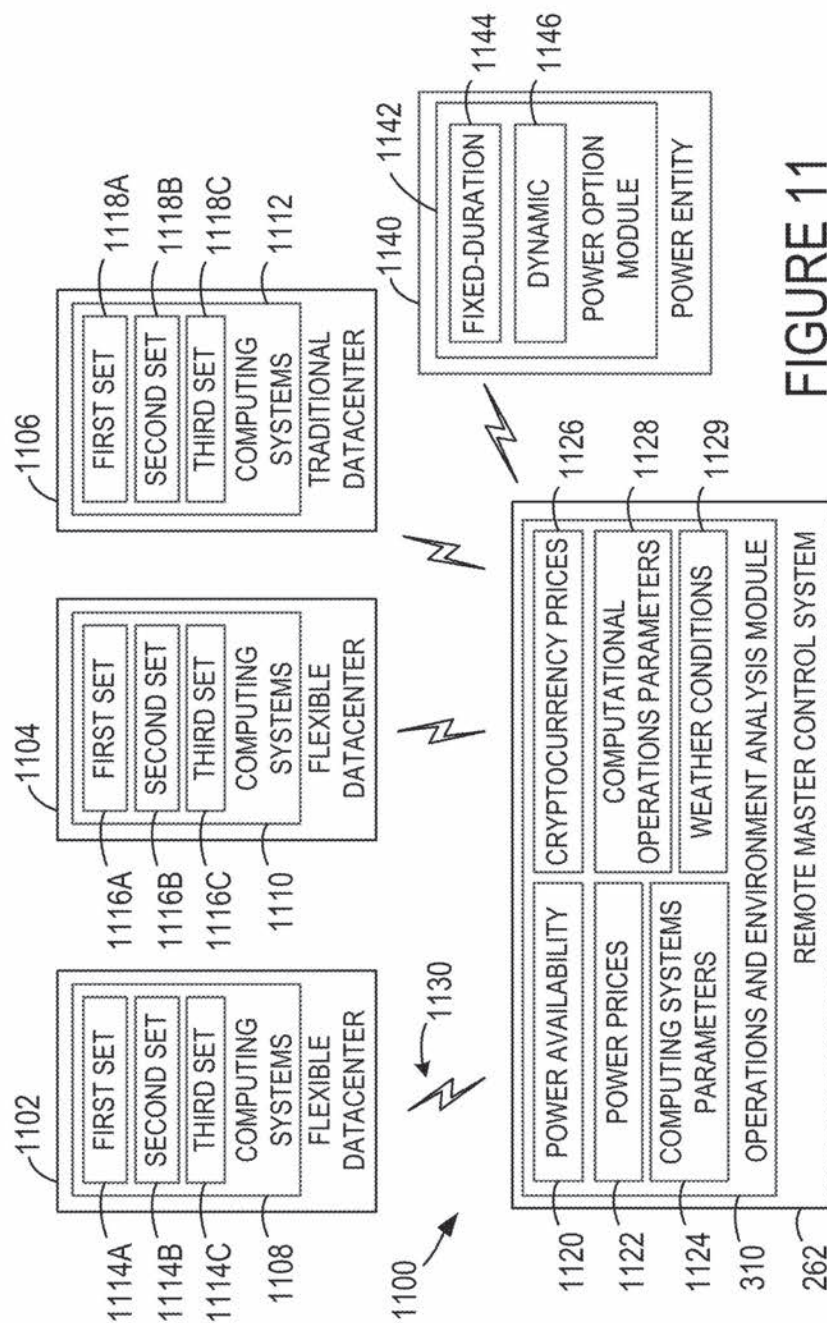


FIGURE 11

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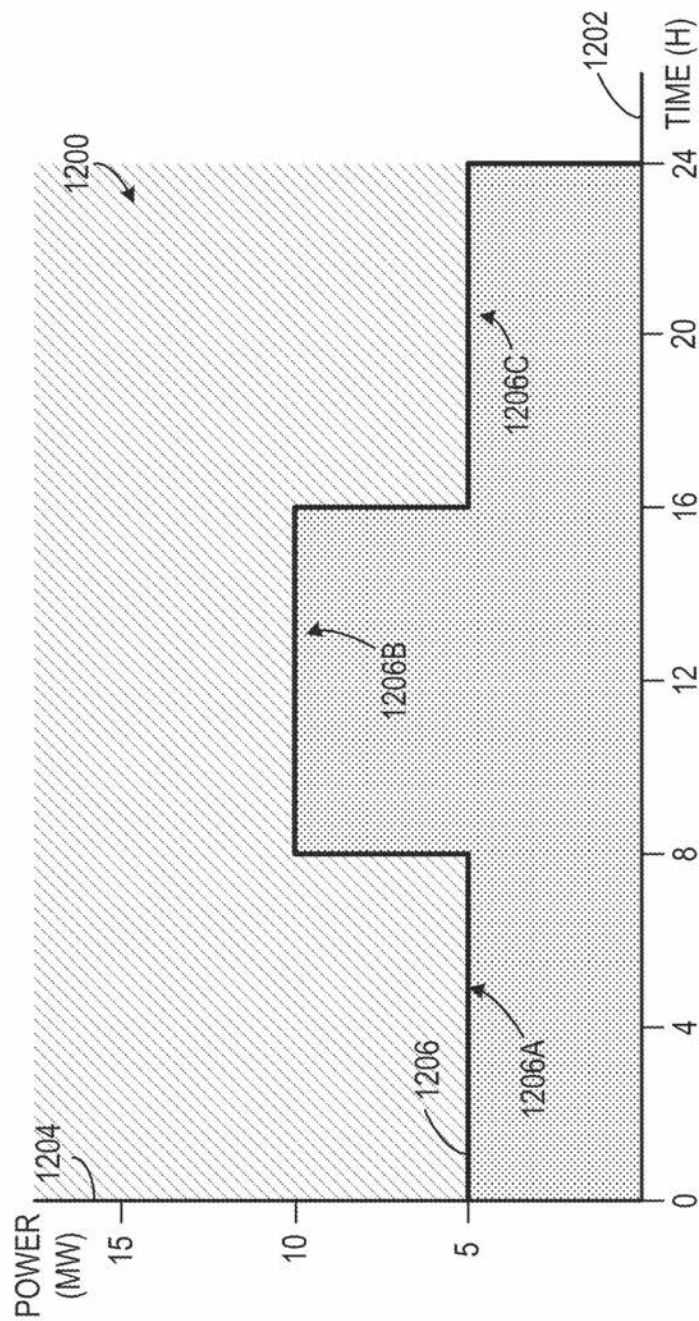


FIGURE 12

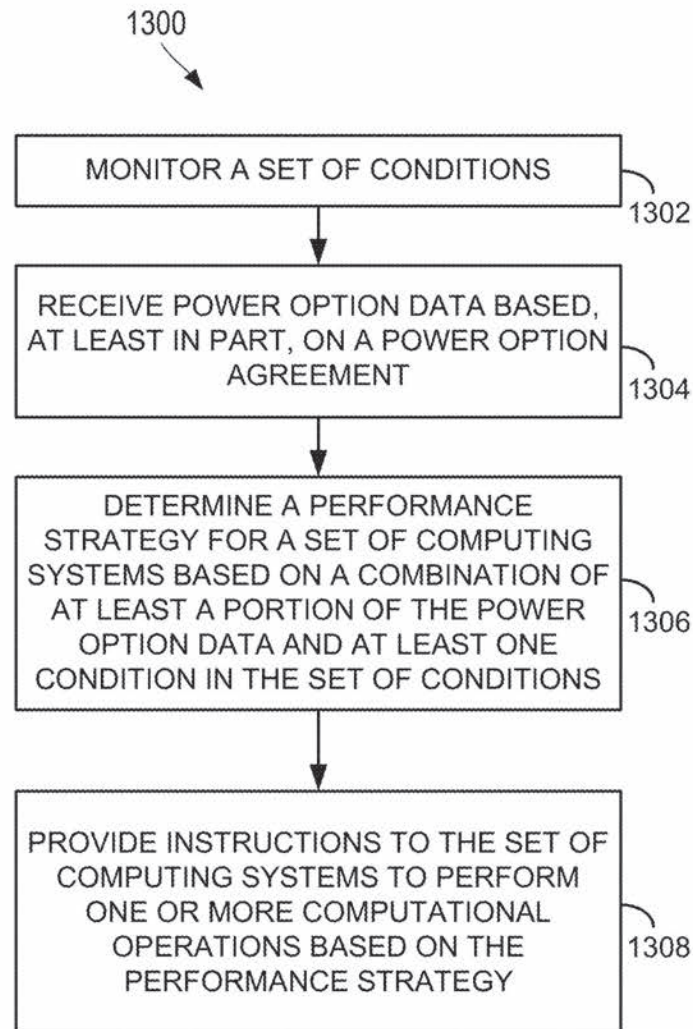


FIGURE 13



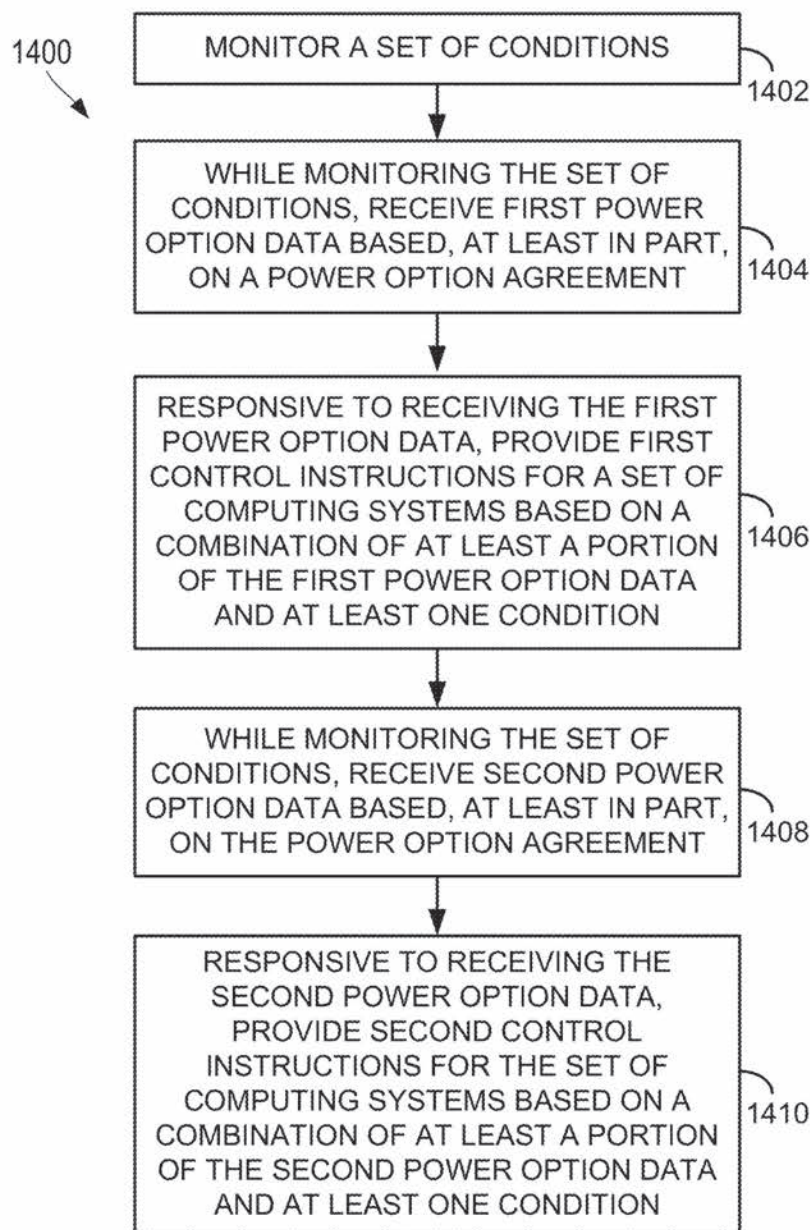


FIGURE 14



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# METHODS AND SYSTEMS FOR ADJUSTING POWER CONSUMPTION BASED ON A FIXED-DURATION POWER OPTION AGREEMENT

## CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Patent Application No. 62/927,119, filed Oct. 28, 2019, the entire contents of which are herein incorporated by reference.

## FIELD

This specification relates to power consumption adjustments when using grid power and/or intermittent behind-the-meter power.

## BACKGROUND

“Electrical grid” or “grid,” as used herein, refers to a Wide Area Synchronous Grid (also known as an Interconnection), and is a regional scale or greater electric power grid that that operates at a synchronized frequency and is electrically tied together during normal system conditions. An electrical grid delivers electricity from generation stations to consumers. An electrical grid includes: (i) generation stations that produce electrical power at large scales for delivery through the grid, (ii) high voltage transmission lines that carry that power from the generation stations to demand centers, and (iii) distribution networks carry that power to individual customers.

FIG. 1 illustrates a typical electrical grid, such as a North American Interconnection or the synchronous grid of Continental Europe (formerly known as the UCTE grid). The electrical grid of FIG. 1 can be described with respect to the various segments that make up the grid.

A generation segment 102 includes one or more generation stations that produce utility-scale electricity (typically >50 MW), such as a nuclear plant 102a, a coal plant 102b, a wind power station (i.e., wind farm) 102c, and/or a photovoltaic power station (i.e., a solar farm) 102d. Generation stations are differentiated from building-mounted and other decentralized or local wind or solar power applications because they supply power at the utility level and scale (>50 MW), rather than to a local user or users. The primary purpose of generation stations is to produce power for distribution through the grid, and in exchange for payment for the supplied electricity. Each of the generation stations 102a-d includes power generation equipment 102e-h, respectively, typically capable of supply utility-scale power (>50 MW). For example, the power generation equipment 102g at wind power station 102c includes wind turbines, and the power generation equipment 102h at photovoltaic power station 102d includes photovoltaic panels.

Each of the generation stations 102a-d may further include station electrical equipment 102i-1 respectively. Station electrical equipment 102i-1 are each illustrated in FIG. 1 as distinct elements for simplified illustrative purposes only and may, alternatively or additionally, be distributed throughout the power generation equipment, 102e-h, respectively. For example, at wind power station 102c, each wind turbine may include transformers, frequency converters, power converters, and/or electrical filters. Energy generated at each wind turbine may be collected by distribution lines along strings of wind turbines and move through

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collectors, switches, transformers, frequency converters, power converters, electrical filters, and/or other station electrical equipment before leaving the wind power station 102c. Similarly, at photovoltaic power station 102d, individual photovoltaic panels and/or arrays of photovoltaic panels may include inverters, transformers, frequency converters, power converters, and/or electrical filters. Energy generated at each photovoltaic panel and/or array may be collected by distribution lines along the photovoltaic panels and move through collectors, switches, transformers, frequency converters, power converters, electrical filters, and/or other station electrical equipment before leaving the photovoltaic power station 102d.

Each generation station 102a-d may produce AC or DC electrical current which is then typically stepped up to a higher AC voltage before leaving the respective generation station. For example, wind turbines may typically produce AC electrical energy at 600V to 700V, which may then be stepped up to 34.5 kV before leaving the generation station 102d. In some cases, the voltage may be stepped up multiple times and to a different voltage before exiting the generation station 102c. As another example, photovoltaic arrays may produce DC voltage at 600V to 900V, which is then inverted to AC voltage and may be stepped up to 34.5 kV before leaving the generation station 102d. In some cases, the voltage may be stepped up multiple times and to a different voltage before exiting the generation station 102d.

Upon exiting the generation segment 102, electrical power generated at generation stations 102a-d passes through a respective Point of Interconnection (“POI”) 103 between a generation station (e.g., 102a-d) and the rest of the grid. A respective POI 103 represents the point of connection between a generation station’s (e.g., 102a-d) equipment and a transmission system (e.g., transmission segment 104) associated with electrical grid. In some cases, at the POI 103, generated power from generation stations 102a-d may be stepped up at transformer systems 103e-h to high voltage scales suitable for long-distance transmission along transmission lines 104a. Typically, the generated electrical energy leaving the POI 103 will be at 115 kV AC or above, but in some cases it may be as low as, for example, 69 kV for shorter distance transmissions along transmission lines 104a. Each of transformer systems 103e-h may be a single transformer or may be multiple transformers operating in parallel or series and may be co-located or located in geographically distinct locations. Each of the transformer systems 103e-h may include substations and other links between the generation stations 102a-d and the transmission lines 104a.

A key aspect of the POI 103 is that this is where generation-side metering occurs. One or more utility-scale generation-side meters 103a-d (e.g., settlement meters) are located at settlement metering points at the respective POI 103 for each generation station 102a-d. The utility-scale generation-side meters 103a-d measure power supplied from generation stations 102a-d into the transmission segment 104 for eventual distribution throughout the grid.

For electricity consumption, the price consumers pay for power distributed through electric power grids is typically composed of, among other costs, Generation, Administration, and Transmission & Distribution (“T&D”) costs. T&D costs represent a significant portion of the overall price paid by consumers for electricity. These costs include capital costs (land, equipment, substations, wire, etc.), costs associated with electrical transmission losses, and operation and maintenance costs.



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For utility-scale electricity supply, operators of generation stations (e.g., **102a-d**) are paid a variable market price for the amount of power the operator generates and provides to the grid, which is typically determined via a power purchase agreement (PPA) between the generation station operator and a grid operator. The amount of power the generation station operator generates and provides to the grid is measured by utility-scale generation-side meters (e.g., **103a-d**) at settlement metering points. As illustrated in FIG. 1, the utility-scale generation-side meters **103a-d** are shown on a low side of the transformer systems **103e-h**, but they may alternatively be located within the transformer systems **103e-h** or on the high side of the transformer systems **103e-h**. A key aspect of a utility-scale generation-side meter is that it is able to meter the power supplied from a specific generation station into the grid. As a result, the grid operator can use that information to calculate and process payments for power supplied from the generation station to the grid. That price paid for the power supplied from the generation station is then subject to T&D costs, as well as other costs, in order to determine the price paid by consumers.

After passing through the utility-scale generation-side meters in the POI **103**, the power originally generated at the generation stations **102a-d** is transmitted onto and along the transmission lines **104a** in the transmission segment **104**. Typically, the electrical energy is transmitted as AC at 115 kV+ or above, though it may be as low as 69 kV for short transmission distances. In some cases, the transmission segment **104** may include further power conversions to aid in efficiency or stability. For example, transmission segment **104** may include high-voltage DC (“HVDC”) portions (along with conversion equipment) to aid in frequency synchronization across portions of the transmission segment **104**. As another example, transmission segment **104** may include transformers to step AC voltage up and then back down to aid in long distance transmission (e.g., 230 kV, 500 kV, 765 kV, etc.).

Power generated at the generation stations **104a-d** is ultimately destined for use by consumers connected to the grid. Once the energy has been transmitted along the transmission segment **104**, the voltage will be stepped down by transformer systems **105a-c** in the step down segment **105** so that it can move into the distribution segment **106**.

In the distribution segment **106**, distribution networks **106a-c** take power that has been stepped down from the transmission lines **104a** and distribute it to local customers, such as local sub-grids (illustrated at **106a**), industrial customers, including large EV charging networks (illustrated at **106b**), and/or residential and retail customers, including individual EV charging stations (illustrated at **106c**). Customer meters **106d**, **106f** measure the power used by each of the grid-connected customers in distribution networks **106a-c**. Customer meters **106d** are typically load meters that are unidirectional and measure power use. Some of the local customers in the distribution networks **106a-d** may have local wind or solar power systems **106e** owned by the customer. As discussed above, these local customer power systems **106e** are decentralized and supply power directly to the customer(s). Customers with decentralized wind or solar power systems **106e** may have customer meters **106f** that are bidirectional or net-metering meters that can track when the local customer power systems **106e** produce power in excess of the customer’s use, thereby allowing the utility to provide a credit to the customer’s monthly electricity bill. Customer meters **106d**, **106f** differ from utility-scale generation-side meters (e.g., settlement meters) in at least the following characteristics: design (electro-mechanical or electronic vs

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current transformer), scale (typically less than 1600 amps vs. typically greater than 50 MW; typically less than 600V vs. typically greater than 14 kV), primary function (use vs. supply metering), economic purpose (credit against use vs. payment for power), and location (in a distribution network at point of use vs. at a settlement metering point at a Point of Interconnection between a generation station and a transmission line).

To maintain stability of the grid, the grid operator strives to maintain a balance between the amount of power entering the grid from generation stations (e.g., **102a-d**) and the amount of grid power used by loads (e.g., customers in the distribution segment **106**). In order to maintain grid stability and manage congestion, grid operators may take steps to reduce the supply of power arriving from generation stations (e.g., **102a-d**) when necessary (e.g., curtailment). Particularly, grid operators may decrease the market price paid for generated power to dis-incentivize generation stations (e.g., **102a-d**) from generating and supplying power to the grid. In some cases, the market price may even go negative such that generation station operators must pay for power they allow into the grid. In addition, some situations may arise where grid operators explicitly direct a generation station (e.g., **102a-d**) to reduce or stop the amount of power the station is supplying to the grid.

Power market fluctuations, power system conditions (e.g., power factor fluctuation or generation station startup and testing), and operational directives resulting in reduced or discontinued generation all can have disparate effects on renewal energy generators and can occur multiple times in a day and last for indeterminate periods of time. Curtailment, in particular, is particularly problematic.

According to the National Renewable Energy Laboratory’s Technical Report TP-6A20-60983 (March 2014):

[C]urtailment [is] a reduction in the output of a generator from what it could otherwise produce given available resources (e.g., wind or sunlight), typically on an involuntary basis. Curtailments can result when operators or utilities command wind and solar generators to reduce output to minimize transmission congestion or otherwise manage the system or achieve the optimal mix of resources. Curtailment of wind and solar resources typically occurs because of transmission congestion or lack of transmission access, but it can also occur for reasons such as excess generation during low load periods that could cause baseload generators to reach minimum generation thresholds, because of voltage or interconnection issues, or to maintain frequency requirements, particularly for small, isolated grids. Curtailment is one among many tools to maintain system energy balance, which can also include grid capacity, hydropower and thermal generation, demand response, storage, and institutional changes. Deciding which method to use is primarily a matter of economics and operational practice.

“Curtailment” today does not necessarily mean what it did in the early 2000s. Two separate changes in the electric sector have shaped curtailment practices since that time: the utility-scale deployment of wind power, which has no fuel cost, and the evolution of wholesale power markets. These simultaneous changes have led to new operational challenges but have also expanded the array of market-based tools for addressing them.

Practices vary significantly by region and market design. In places with centrally-organized wholesale power markets and experience with wind power, manual wind energy curtailment processes are increasingly being



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replaced by transparent offer-based market mechanisms that base dispatch on economics. Market protocols that dispatch generation based on economics can also result in renewable energy plants generating less than what they could potentially produce with available wind or sunlight. This is often referred to by grid operators by other terms, such as "downward dispatch." In places served primarily by vertically integrated utilities, power purchase agreements (PPAs) between the utility and the wind developer increasingly contain financial provisions for curtailment contingencies.

Some reductions in output are determined by how a wind operator values dispatch versus non-dispatch. Other curtailments of wind are determined by the grid operator in response to potential reliability events. Still other curtailments result from overdevelopment of wind power in transmission-constrained areas.

Dispatch below maximum output (curtailment) can be more of an issue for wind and solar generators than it is for fossil generation units because of differences in their cost structures. The economics of wind and solar generation depend on the ability to generate electricity whenever there is sufficient sunlight or wind to power their facilities.

Because wind and solar generators have substantial capital costs but no fuel costs (i.e., minimal variable costs), maximizing output improves their ability to recover capital costs. In contrast, fossil generators have higher variable costs, such as fuel costs. Avoiding these costs can, depending on the economics of a specific generator, to some degree reduce the financial impact of curtailment, especially if the generator's capital costs are included in a utility's rate base.

Curtailment may result in available energy being wasted because solar and wind operators have zero variable cost (which may not be true to the same extent for fossil generation units which can simply reduce the amount of fuel that is being used). With wind generation, in particular, it may also take some time for a wind farm to become fully operational following curtailment. As such, until the time that the wind farm is fully operational, the wind farm may not be operating with optimum efficiency and/or may not be able to provide power to the grid.

#### SUMMARY

In an example, a system includes a set of computing systems. The set of computing systems is configured to perform computational operations using power from a power grid. The system also includes a control system configured to monitor a set of conditions and, while monitoring the set of conditions, receive first power option data based, at least in part, on a power option agreement. The first power option data specify a first minimum power threshold associated with a first time interval. The control system is further configured to provide first control instructions for the set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions responsive to receiving the first power option data. The first control instructions comprises a first power consumption target for the set of computing systems for the first time interval, and the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval. The control system is also configured to, while monitoring the set of conditions, receive second power option data based, at least in part, on the power option

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agreement. The second power option data specify a second minimum power threshold associated with a second time interval. Responsive to receiving the second power option data, the control system is configured to provide second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions. The second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and wherein the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

In another example, a method involves monitoring, at a computing system, a set of conditions, and while monitoring the set of conditions, receiving first power option data based, at least in part, on a power option agreement. The first power option data specify a first minimum power threshold associated with a first time interval. The method further involves, responsive to receiving the first power option data, providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions. The first control instructions comprises a first power consumption target for the set of computing systems for the first time interval, and the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval. The method further involves, while monitoring the set of conditions, receiving second power option data based, at least in part, on the power option agreement. The second power option data specify a second minimum power threshold associated with a second time interval. The method also involves, responsive to receiving the second power option data, providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions. The second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

In yet another example, a system is provided. The system includes a set of computing systems, where the set of computing systems is configured to perform computational operations using power from a power grid. The system also includes a control system configured to monitor a set of conditions and receive power option data based, at least in part, on a power option agreement. The power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, where each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals. The control system is further configured to, responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions. The performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, where each power consumption target is equal to or greater than the minimum power threshold associated with each time interval. The control system is also configured to provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.

In a further example, non-transitory computer-readable medium is described that is configured to store instructions,



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that when executed by a computing system, causes the computing system to perform operations consistent with the method steps described above.

Other aspects of the present invention will be apparent from the following description and claims.

#### BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 shows a typical electrical grid.

FIG. 2 shows a behind-the-meter arrangement with optional grid power, including one or more flexible datacenters, according to one or more example embodiments.

FIG. 3 shows a block diagram of a remote master control system, according to one or more example embodiments.

FIG. 4 a block diagram of a generation station, according to one or more example embodiments.

FIG. 5 shows a block diagram of a flexible datacenter, according to one or more example embodiments.

FIG. 6A shows a structural arrangement of a flexible datacenter, according to one or more example embodiments.

FIG. 6B shows a set of computing systems arranged in a straight configuration, according to one or more example embodiments.

FIG. 7 shows a control distribution system for a flexible datacenter, according to one or more example embodiments.

FIG. 8 shows a control distribution system for a fleet of flexible datacenters, according to one or more example embodiments.

FIG. 9 shows a queue distribution system for a traditional datacenter and a flexible datacenter, according to one or more example embodiments.

FIG. 10A shows a method of dynamic power consumption at a flexible datacenter using behind-the-meter power, according to one or more example embodiments.

FIG. 10B shows a method of dynamic power delivery at a flexible datacenter using behind-the-meter power, according to one or more example embodiments.

FIG. 11 shows a block diagram of a system for implementing power consumption adjustments based on a power option agreement, according to one or more embodiments.

FIG. 12 shows a graph representing power option data based on a power option agreement, according to one or more embodiments.

FIG. 13 shows a method for implementing power consumption adjustments based on a fixed-duration power option agreement, according to one or more embodiments.

FIG. 14 shows a method for implementing power consumption adjustments based on a dynamic power option agreement, according to one or more embodiments.

#### DETAILED DESCRIPTION

Disclosed examples will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all of the disclosed examples are shown. Different examples may be described and should not be construed as limited to the examples set forth herein.

As discussed above, the market price paid to generation stations for supplying power to the grid often fluctuates due to various factors, including the need to maintain grid stability and based on current demand and usage by connected loads in distribution networks. Due to these factors, situations can arise where generation stations are offered substantially lower prices to deter an over-supply of power to the grid. Although these situations typically exist temporarily, generation stations are sometimes forced to either sell power to the grid at the much lower prices or adjust

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operations to decrease the amount of power generated. Furthermore, some situations may even require generation stations to incur costs in order to offload power to the grid or to shut down generation temporarily.

The volatility in the market price offered for power supplied to the grid can be especially problematic for some types of generation stations. In particular, wind farms and some other types of renewable resource power producers may lack the ability to quickly adjust operations in response to changes in the market price offered for supplying power to the grid. As a result, power generation and management at some generation stations can be inefficient, which can frequently result in power being sold to the grid at low or negative prices. In some situations, a generation station may even opt to halt power generation temporarily to avoid such unfavorable pricing. As such, the time required to halt and to restart the power generation at a generation station can reduce the generation station's ability to take advantage of rising market prices for power supplied to the grid.

Example embodiments provided herein aim to assist generation stations in managing power generation operations and avoid unfavorable power pricing situations like those described above. In particular, example embodiments may involve providing a load that is positioned behind-the-meter ("BTM") and enabling the load to utilize power received behind-the-meter at a generation station in a timely manner. As a general rule of thumb, BTM power is not subject to traditional T&D costs.

For purposes herein, a generation station is considered to be configured for the primary purpose of generating utility-scale power for supply to the electrical grid (e.g., a Wide Area Synchronous Grid or a North American Interconnect).

In one embodiment, equipment located behind-the-meter ("BTM equipment") is equipment that is electrically connected to a generation station's power generation equipment behind (i.e., prior to) the generation station's POI with an electrical grid.

In one embodiment, behind-the-meter power ("BTM power") is electrical power produced by a generation station's power generation equipment and utilized behind (i.e., prior to) the generation station's POI with an electrical grid.

In another embodiment, equipment may be considered behind-the-meter if it is electrically connected to a generation station that is subject to metering by a utility-scale generation-side meter (e.g., settlement meter), and the BTM equipment receives power from the generation station, but the power received by the BTM equipment from the generation station has not passed through the utility-scale generation-side meter. In one embodiment, the utility-scale generation-side meter for the generation station is located at the generation station's POI. In another embodiment, the utility-scale generation-side meter for the generation station is at a location other than the POI for the generation station—for example, a substation between the generation station and the generation station's POI.

In another embodiment, power may be considered behind-the-meter if it is electrical power produced at a generation station that is subject to metering by a utility-scale generation-side meter (e.g., settlement meter), and the BTM power is utilized before being metered at the utility-scale generation-side meter. In one embodiment, the utility-scale generation-side meter for the generation station is located at the generation station's POI. In another embodiment, the utility-scale generation-side meter for the generation station is at a location other than the POI for the generation station—for example, a substation between the generation station and the generation station's POI.



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In another embodiment, equipment may be considered behind-the-meter if it is electrically connected to a generation station that supplies power to a grid, and the BTM equipment receives power from the generation station that is not subject to T&D charges, but power received from the grid that is supplied by the generation station is subject to T&D charges.

In another embodiment, power may be considered behind-the-meter if it is electrical power produced at a generation station that supplies power to a grid, and the BTM power is not subject to T&D charges before being used by electrical equipment, but power received from the grid that is supplied by the generation station is subject to T&D charges.

In another embodiment, equipment may be considered behind-the-meter if the BTM equipment receives power generated from the generation station and that received power is not routed through the electrical grid before being delivered to the BTM equipment.

In another embodiment, power may be considered behind-the-meter if it is electrical power produced at a generation station, and BTM equipment receives that generated power, and that generated power received by the BTM equipment is not routed through the electrical grid before being delivered to the BTM equipment.

For purposes herein, BTM equipment may also be referred to as a behind-the-meter load ("BTM load") when the BTM equipment is actively consuming BTM power.

Beneficially, where BTM power is not subject to traditional T&D costs, a wind farm or other type of generation station can be connected to BTM loads which can allow the generation station to selectively avoid the adverse or less-than optimal cost structure occasionally associated with supplying power to the grid by shunting generated power to the BTM load.

An arrangement that positions and connects a BTM load to a generation station can offer several advantages. In such arrangements, the generation station may selectively choose whether to supply power to the grid or to the BTM load, or both. The operator of a BTM load may pay to utilize BTM power at a cost less than that charged through a consumer meter (e.g., 106d, 1060 located at a distribution network (e.g., 106a-c) receiving power from the grid. The operator of a BTM load may additionally or alternatively charge less than the market rate to consume excess power generated at the generation station during curtailment. As a result, the generation station may direct generated power based on the "best" price that the generation station can receive during a given time frame, and/or the lowest cost the generation station may incur from negative market pricing during curtailment. The "best" price may be the highest price that the generation station may receive for its generated power during a given duration, but can also differ within embodiments and may depend on various factors, such as a prior PPA.

In one example, by having a behind-the-meter option available, a generation station may transition from supplying all generated power to the grid to supplying some or all generated power to one or more BTM loads when the market price paid for power by grid operators drops below a predefined threshold (e.g., the price that the operator of the BTM load is willing to pay the generation station for power). Thus, by having an alternative option for power consumption (i.e., one or more BTM loads), the generation station can selectively utilize the different options to maximize the price received for generated power. In addition, the generation station may also utilize a BTM load to avoid or reduce

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the economic impact in situations when supplying power to the grid would result in the generation station incurring a net cost.

Providing BTM power to a load can also benefit the BTM load operator. A BTM load may be able to receive and utilize BTM power received from the generation station at a cost that is lower than the cost for power from the grid (e.g., at a customer meter 106d, 1060. This is primarily due to the avoidance (or significant reduction) in T&D costs and the market effects of curtailment. As indicated above, the generation station may be willing to divert generated power to the BTM load rather than supplying the grid due to changing market conditions, or during maintenance periods, or for other non-market conditions. Thus, some situations may arise where the generation station offers power to the BTM load at a price that is substantially lower than the price available on the grid. Furthermore, in some situations, the BTM load may even be able to obtain and utilize BTM power from a generation station at no cost or even at negative pricing since the generation station may rather supply the BTM load with generated power during a given time range instead of paying a higher price for the grid to take the power or modifying operations to decrease power output.

Another example of cost-effective use of BTM power is when the generation station 202 is selling power to the grid at a negative price that is offset by a production tax credit. In certain circumstances, the value of the production tax credit may exceed the price the generation station 202 would have to pay to the grid power to offload generation's station 202 generated power. Advantageously, one or more flexible datacenters 220 may take the generated power behind-the-meter, thereby allowing the generation station 202 to produce and obtain the production tax credit, while selling less power to the grid at the negative price.

Another example of cost-effective behind-the-meter power is when the generation station 202 is selling power to the grid at a negative price because the grid is oversupplied and/or the generation station 202 is instructed to stand down and stop producing altogether. A grid operator may select and direct certain generation stations to go offline and stop supplying power to the grid. Advantageously, one or more flexible datacenters may be used to take power behind-the-meter, thereby allowing the generation station 202 to stop supplying power to the grid, but still stay online and make productive use of the power generated.

Another example of beneficial behind-the-meter power use is when the generation station 202 is producing power that is, with reference to the grid, unstable, out of phase, or at the wrong frequency, or the grid is already unstable, out of phase, or at the wrong frequency. A grid operator may select certain generation stations to go either offline and stop producing power, or to take corrective action with respect to the grid power stability, phase, or frequency. Advantageously, one or more flexible datacenters 220 may be used to selectively consume power behind-the-meter, thereby allowing the generation station 202 to stop providing power to the grid and/or provide corrective feedback to the grid.

Another example of beneficial behind-the-meter power use is that cost-effective behind-the-meter power availability may occur when the generation station 202 is starting up or testing. Individual equipment in the power generation equipment 210 may be routinely offline for installation, maintenance, and/or service and the individual units must be tested prior to coming online as part of overall power generation equipment 210. During such testing or maintenance time, one or more flexible datacenters may be intermittently



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powered by the one or more units of the power generation equipment 210 that are offline from the overall power generation equipment 210.

Another example of beneficial behind-the-meter power use is that datacenter control systems at the flexible datacenters 220 may quickly ramp up and ramp down power consumption by computing systems in the flexible datacenters 220 based on power availability from the generation station 202. For instance, if the grid requires additional power and signals the demand via a higher local price for power, the generation station 202 can supply the grid with power nearly instantly by having active flexible datacenters 220 quickly ramp down and turn off computing systems (or switch to a stored energy source), thereby reducing an active BTM load.

Another example of beneficial behind-the-meter power use is in new photovoltaic generation stations 202. For example, it is common to design and build new photovoltaic generation stations with a surplus of power capacity to account for degradation in efficiency of the photovoltaic panels over the life of the generation stations. Excess power availability at the generation station can occur when there is excess local power generation and/or low grid demand. In high incident sunlight situations, a photovoltaic generation station 202 may generate more power than the intended capacity of generation station 202. In such situations, a photovoltaic generation station 202 may have to take steps to protect its equipment from damage, which may include taking one or more photovoltaic panels offline or shunting their voltage to dummy loads or the ground. Advantageously, one or more flexible datacenters (e.g., the flexible datacenters 220) may take power behind-the-meter at the Generation Station 202, thereby allowing the generation station 202 to operate the power generation equipment 210 within operating ranges while the flexible datacenters 220 receive BTM power without transmission or distribution costs.

Thus, for at least the reasons described herein, arrangements that involves providing a BTM load as an alternative option for a generation station to direct its generated power to can serve as a mutually beneficial relationship in which both the generation station and the BTM load can economically benefit. The above-noted examples of beneficial use of BTM power are merely exemplary and are not intended to limit the scope of what one of ordinary skill in the art would recognize as benefits to unutilized BTM power capacity, BTM power pricing, or BTM power consumption.

Within example embodiments described herein, various types of utility-scale power producers may operate as generation stations 202 that are capable of supplying power to one or more loads behind-the-meter. For instance, renewable energy sources (e.g., wind, solar, hydroelectric, wave, water current, tidal), fossil fuel power generation sources (coal, natural gas), and other types of power producers (e.g., nuclear power) may be positioned in an arrangement that enables the intermittent supply of generated power behind-the-meter to one or more BTM loads. One of ordinary skill in the art will recognize that the generation station 202 may vary based on an application or design in accordance with one or more example embodiments.

In addition, the particular arrangement (e.g., connections) between the generation station and one or more BTM loads can vary within examples. In one embodiment, a generation station may be positioned in an arrangement wherein the generation station selectively supplies power to the grid and/or to one or more BTM loads. As such, power cost-analysis and other factors (e.g., predicted weather condi-

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tions, contractual obligations, etc.) may be used by the generation station, a BTM load control system, a remote master control system, or some other system or enterprise, to selectively output power to either the grid or to one or more BTM loads in a manner that maximizes revenue to the generation station. In such an arrangement, the generation station may also be able to supply both the grid and one or more BTM loads simultaneously. In some instances, the arrangement may be configured to allow dynamic manipulation of the percentage of the overall generated power that is supplied to each option at a given time. For example, in some time periods, the generation station may supply no power to the BTM load.

In addition, the type of loads that are positioned behind-the-meter can vary within example embodiments. In general, a load that is behind-the-meter may correspond to any type of load capable of receiving and utilizing power behind-the-meter from a generation station. Some examples of loads include, but are not limited to, datacenters and electric vehicle (EV) charging stations.

Preferred BTM loads are loads that can be subject to intermittent power supply because BTM power may be available intermittently. In some instances, the generation station may generate power intermittently. For example, wind power station 102c and/or photovoltaic power station 102d may only generate power when resource are available or favorable. Additionally or alternatively, BTM power availability at a generation station may only be available intermittently due to power market fluctuations, power system conditions (e.g., power factor fluctuation or generation station startup and testing), and/or operational directives from grid operators or generation station operators.

Some example embodiments of BTM loads described herein involve using one or more computing systems to serve as a BTM load at a generation station. In particular, the computing system or computing systems may receive power behind-the-meter from the generation station to perform various computational operations, such as processing or storing information, performing calculations, mining for cryptocurrencies, supporting blockchain ledgers, and/or executing applications, etc.

Multiple computing systems positioned behind-the-meter may operate as part of a "flexible" datacenter that is configured to operate only intermittently and to receive and utilize BTM power to carry out various computational operations similar to a traditional datacenter. In particular, the flexible datacenter may include computing systems and other components (e.g., support infrastructure, a control system) configured to utilize BTM power from one or more generation stations. The flexible datacenter may be configured to use particular load ramping abilities (e.g., quickly increase or decrease power usage) to effectively operate during intermittent periods of time when power is available from a generation station and supplied to the flexible datacenter behind-the-meter, such as during situations when supplying generated power to the grid is not favorable for the generation station.

In some instances, the amount of power consumed by the computing systems at a flexible datacenter can be ramped up and down quickly, and potentially with high granularity (i.e., the load can be changed in small increments if desired). This may be done based on monitored power system conditions or other information analyses as discussed herein. As recited above, this can enable a generation station to avoid negative power market pricing and to respond quickly to grid direc-



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tives. And by extension, the flexible datacenter may obtain BTM power at a price lower than the cost for power from the grid.

Various types of computing systems can provide granular power ramping. Preferably, the computing systems can perform computational tasks that are immune to, or not substantially hindered by, frequent interruptions or slow-downs in processing as the computing systems ramp down or up. In some embodiments, a control system may be used to activate or de-activate one or more computing systems in an array of computing systems. For example, the control system may provide control instructions to one or more blockchain miners (e.g., a group of blockchain miners), including instructions for powering on or off, adjusting frequency of computing systems performing operations (e.g., adjusting the processing frequency), adjusting the quantity of operations being performed, and when to operate within a low power mode (if available).

Within examples, a control system may correspond to a specialized computing system or may be a computing system within a datacenter serving in the role of the control system. The location of the control system can vary within examples as well. For instance, the control system may be located at a datacenter or physically separate from the datacenter. In some examples, the control system may be part of a network of control systems that manage computational operations, power consumption, and other aspects of a fleet of datacenters. The fleet of datacenters may include one or more traditional datacenters and/or flexible datacenters.

Some embodiments may involve using one or more control systems to direct time-insensitive (e.g., interruptible) computational tasks to computational hardware, such as central processing units (CPUs) and graphics processing units (GPUs), sited behind the meter (i.e., consuming metered grid power via a customer meter (e.g., 106d, 1060) and possibly remote from the behind-the-meter hardware. As such, parallel computing processes, such as Monte Carlo simulations, batch processing of financial transactions, graphics rendering, machine learning, neural network processing, queued operations, and oil and gas field simulation models, are good candidates for such interruptible computational operations.

FIG. 2 shows a behind-the-meter arrangement with optional grid-power, including one or more flexible datacenters, according to one or more example embodiments. Dark arrows illustrate a typical power delivery direction. Consistent with FIG. 1, the arrangement illustrates a generation station 202 in the generation segment 102 of a Wide-Area Synchronous Grid. The generation station 202 supplies utility-scale power (typically >50 MW) via a generation power connection 250 to the Point of Interconnection 103 between the generation station 202 and the rest of the grid. Typically, the power supplied on connection 250 may be at 34.5 kV AC, but it may be higher or lower. Depending on the voltage at connection 250 and the voltage at transmission lines 104a, a transformer system 203 may step up the power supplied from the generation station 202 to high voltage (e.g., 115 kV+AC) for transmission over connection 252 and onto transmission lines 104a of transmission segment 104. Grid power carried on the transmission segment 104 may be from generation station 202 as well as other generation stations (not shown). Also consistent with FIG. 1, grid power is consumed at one or more distribution networks, including example distribution network 206. Grid power may be taken from the transmission lines 104a via connector 254 and stepped down to distribution network

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voltages (e.g., typically 4 kV to 26 kV AC) and sent into the distribution networks, such as distribution network 206 via distribution line 256. The power on distribution line 256 may be further stepped down (not shown) before entering individual consumer facilities such as a remote master control system 262 and/or traditional datacenters 260 via customer meters 206A, which may correspond to customer meters 106d in FIG. 1, or customer meters 106f in FIG. 1 if the respective consumer facility includes a local customer power system, such as 106e (not shown in FIG. 2).

Consistent with FIG. 1, power entering the grid from generation station 202 is metered by a utility-scale generation-side meter. A utility-scale generation-side meter 253 is shown on the low side of transformer system 203 and an alternative location is shown as 253A on the high side of transformer system 203. Both locations may be considered settlement metering points for the generation station 202 at the POI 103. Alternatively, a utility-scale generation-side meter for the generation station 202 may be located at another location consistent with the descriptions of such meters provided herein.

Generation station 202 includes power generation equipment 210, which may include, as examples, wind turbines and/or photovoltaic panels. Power generation equipment 210 may further include other electrical equipment, including but not limited to switches, busses, collectors, inverters, and power unit transformers (e.g., transformers in wind turbines).

As illustrated in FIG. 2, generation station 202 is configured to connect with BTM equipment which may function as BTM loads. In the illustrated embodiment of FIG. 2, the BTM equipment includes flexible datacenters 220. Various configurations to supply BTM power to flexible datacenters 220 within the arrangement of FIG. 2 are described herein.

In one configuration, generated power may travel from the power generation equipment 210 over one or more connectors 230A, 230B to one or more electrical busses 240A, 240B, respectively. Each of the connectors 230A, 230B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, connector 230B is shown with an open switch, and connector 230A is shown with a closed switch, but either or both may be reversed in some embodiments. Aspects of this configuration can be used in various embodiments when BTM power is supplied without significant power conversion to BTM loads.

In various configurations, the busses 240A and 240B may be separated by an open switch 240C or combined into a common bus by a closed switch 240C.

In another configuration, generated power may travel from the power generation equipment 210 to the high side of a local step-down transformer 214. The generated power may then travel from the low side of the local step-down transformer 214 over one or more connectors 232A, 232B to the one or more electrical busses 240A, 240B, respectively. Each of the connectors 232A, 232B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, connector 232A is shown with an open switch, and connector 232B is shown with a closed switch, but either or both may be reversed in some embodiments. Aspects of this configuration can be used when it is preferable to connect BTM power to the power generation equipment 210, but the generated power must be stepped down prior to use at the BTM loads.

In another configuration, generated power may travel from the power generation equipment 210 to the low side of a local step-up transformer 212. The generated power may



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then travel from the high side of the local step-up transformer 212 over one or more connectors 234A, 234B to the one or more electrical busses 240A, 240B, respectively. Each of the connectors 234A, 234B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, both connectors 234A, 234B are shown with open switches, but either or both may be closed in some embodiments. Aspects of this configuration can be used when it is preferable to connect BTM power to the outbound connector 250 or the high side of the local step-up transformer 212.

In another configuration, generated power may travel from the power generation equipment 210 to the low side of the local step-up transformer 212. The generated power may then travel from the high side of the local step-down transformer 213 to the high side of local step-down transformer 213. The generated power may then travel from the low side of the local step-down transformer 213 over one or more connectors 236A, 236B to the one or more electrical busses 240A, 240B, respectively. Each of the connectors 236A, 236B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, both connectors 236A, 236B are shown with open switches, but either or both may be closed in some embodiments. Aspects of this configuration can be used when it is preferable to connect BTM power to the outbound connector 250 or the high side of the local step-up transformer 212, but the power must be stepped down prior to use at the BTM loads.

In one embodiment, power generated at the generation station 202 may be used to power a generation station control system 216 located at the generation station 202, when power is available. The generation station control system 216 may typically control the operation of the generation station 202. Generated power used at the generation station control system 216 may be supplied from bus 240A via connector 216A and/or from bus 240B via connector 216B. Each of the connectors 216A, 216B may be a switched connector such that power may be routed independently to 240A and/or 240B. While the generation station control system 216 can consume BTM power when powered via bus 240A or bus 240B, the BTM power taken by generation station control system 216 is insignificant in terms of rendering an economic benefit. Further, the generation station control system 216 is not configured to operate intermittently, as it generally must remain always on. Further still, the generation station control system 216 does not have the ability to quickly ramp a BTM load up or down.

In another embodiment, grid power may alternatively or additionally be used to power the generation station control system 216. As illustrated here, metered grid power from a distribution network, such as distribution network 206 for simplicity of illustration purposes only, may be used to power generation station control system 216 over connector 216C. Connector 216C may be a switched connector so that metered grid power to the generation station control system 216 can be switched on or off as needed. More commonly, metered grid power would be delivered to the generation station control system 216 via a separate distribution network (not shown), and also over a switched connector. Any such grid power delivered to the generation station control system 216 is metered by a customer meter 206A and subject to T&D costs.

In another embodiment, when power generation equipment 210 is in an idle or off state and not generating power, grid power may backfeed into generation station 202

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through POI 103 and such grid power may power the generation station control system 216.

In some configurations, an energy storage system 218 may be connected to the generation station 202 via connector 218A, which may be a switched connector. For illustrative purposes only, connector 218A is shown with an open switch but in some embodiments it may be closed. The energy storage system 218 may be connected to bus 240A and/or bus 240B and store energy produced by the power generation equipment 210. The energy storage system may also be isolated from generation station 202 by switch 242A. In times of need, such as when the power generation equipment in an idle or off state and not generating power, the energy storage system may feed power to, for example, the flexible datacenters 220. The energy storage system may also be isolated from the flexible datacenters 220 by switch 242B.

In a preferred embodiment, as illustrated, power generation equipment 210 supplies BTM power via connector 242 to flexible datacenters 220. The BTM power used by the flexible datacenters 220 was generated by the generation station 202 and did not pass through the POI 103 or utility-scale generation-side meter 253, and is not subject to T&D charges. Power received at the flexible datacenters 220 may be received through respective power input connectors 220A. Each of the respective connectors 220A may be a switched connector that can electrically isolate the respective flexible datacenter 220 from the connector 242. Power equipment 220B may be arranged between the flexible datacenters 220 and the connector 242. The power equipment 220B may include, but is not limited to, power conditioners, unit transformers, inverters, and isolation equipment. As illustrated, each flexible datacenter 220 may be served by a respective power equipment 220B. However, in another embodiment, one power equipment 220B may serve multiple flexible datacenter 220.

In one embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter and electrically connected to the power generation equipment 210 behind (i.e., prior to) the generation station's POI 103 with the rest of the electrical grid.

In one embodiment, BTM power produced by the power generation equipment 210 is utilized by the flexible datacenters 220 behind (i.e., prior to) the generation station's POI with an electrical grid.

In another embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter as the flexible datacenters 220 are electrically connected to the generation station 202, and generation station 202 is subject to metering by utility-scale generation-side meter 253 (or 253A, or another utility-scale generation-side meter), and the flexible datacenters 220 receive power from the generation station 202, but the power received by the flexible datacenters 220 from the generation station 202 has not passed through a utility-scale generation-side meter. In this embodiment, the utility-scale generation-side meter 253 (or 253A) for the generation station 202 is located at the generation station's POI 103. In another embodiment, the utility-scale generation-side meter for the generation station 202 is at a location other than the POI for the generation station 202—for example, a substation (not shown) between the generation station 202 and the generation station's POI 103.

In another embodiment, power from the generation station 202 is supplied to the flexible datacenters 220 as BTM power, where power produced at the generation station 202 is subject to metering by utility-scale generation-side meter



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253 (or 253A, or another utility-scale generation-side meter), but the BTM power supplied to the flexible datacenters 220 is utilized before being metered at the utility-scale generation-side meter 253 (or 253A, or another utility-scale generation-side meter). In this embodiment, the utility-scale generation-side meter 253 (or 253A) for the generation station 202 is located at the generation station's 202 POI 103. In another embodiment, the utility-scale generation-side meter for the generation station 202 is at a location other than the POI for the generation station 202—for example, a substation (not shown) between the generation station 202 and the generation station's POI 103.

In another embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter as they are electrically connected to the generation station 202 that supplies power to the grid, and the flexible datacenters 220 receive power from the generation station 202 that is not subject to T&D charges, but power otherwise received from the grid that is supplied by the generation station 202 is subject to T&D charges.

In another embodiment, power from the generation station 202 is supplied to the flexible datacenters 220 as BTM power, where electrical power is generated at the generation station 202 that supplies power to a grid, and the generated power is not subject to T&D charges before being used by flexible datacenters 220, but power otherwise received from the connected grid is subject to T&D charges.

In another embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter because they receive power generated from the generation station 202 intended for the grid, and that received power is not routed through the electrical grid before being delivered to the flexible datacenters 220.

In another embodiment, power from the generation station 202 is supplied to the flexible datacenters 220 as BTM power, where electrical power is generated at the generation station 202 for distribution to the grid, and the flexible datacenters 220 receive that power, and that received power is not routed through the electrical grid before being delivered to the flexible datacenters 220.

In another embodiment, metered grid power may alternatively or additionally be used to power one or more of the flexible datacenters 220, or a portion within one or more of the flexible datacenters 220. As illustrated here for simplicity, metered grid power from a distribution network, such as distribution network 206, may be used to power one or more flexible datacenters 220 over connector 256A and/or 256B. Each of connector 256A and/or 256B may be a switched connector so that metered grid power to the flexible datacenters 220 can be switched on or off as needed. More commonly, metered grid power would be delivered to the flexible datacenters 220 via a separate distribution network (not shown), and also over switched connectors. Any such grid power delivered to the flexible datacenters 220 is metered by customer meters 206A and subject to T&D costs. In one embodiment, connector 256B may supply metered grid power to a portion of one or more flexible datacenters 220. For example, connector 256B may supply metered grid power to control and/or communication systems for the flexible datacenters 220 that need constant power and cannot be subject to intermittent BTM power. Connector 242 may supply solely BTM power from the generation station 202 to high power demand and computing systems within the flexible datacenters 220, in which case at least a portion of each flexible datacenters 220 so connected is operating as a BTM load. In another embodiment, connector 256A and/or 256B may supply all power used at one or more of the flexible

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datacenters 220, in which case each of the flexible datacenters 220 so connected would not be operating as a BTM load.

In another embodiment, when power generation equipment 210 is in an idle or off state and not generating power, grid power may backfeed into generation station 202 through POI 103 and such grid power may power the flexible datacenters 220.

The flexible datacenters 220 are shown in an example arrangement relative to the generation station 202. Particularly, generated power from the generation station 202 may be supplied to the flexible datacenters 220 through a series of connectors and/or busses (e.g., 232B, 240B, 242, 220A). As illustrated, in other embodiments, connectors between the power generation equipment 210 and other components may be switched open or closed, allowing other pathways for power transfer between the power generation equipment 210 and components, including the flexible datacenters 220. Additionally, the connector arrangement shown is illustrative only and other circuit arrangements are contemplated within the scope of supplying BTM power to a BTM load at generation station 202. For example, there may be more or fewer transformers, or one or more of transformers 212, 213, 214 may be transformer systems with multiple steppings and/or may include additional power equipment including but not limited to power conditioners, filters, switches, inverters, and/or AC/DC-DC/AC isolators. As another example, metered grid power connections to flexible datacenters 220 are shown via both 256A and 256B; however, a single connection may connect one or more flexible datacenters 220 (or power equipment 220B) to metered grid power and the one or more flexible datacenters 220 (or power equipment 220B) may include switching apparatus to direct BTM power and/or metered grid power to control systems, communication systems, and/or computing systems as desired.

In some examples, BTM power may arrive at the flexible datacenters 220 in a three-phase AC format. As such, power equipment (e.g., power equipment 220B) at one or more of the flexible datacenters 220 may enable each flexible datacenter 220 to use one or more phases of the power. For instance, the flexible datacenters 220 may utilize power equipment (e.g., power equipment 220B, or alternatively or additionally power equipment that is part of the flexible datacenter 220) to convert BTM power received from the generation station 202 for use at computing systems at each flexible datacenter 220. In other examples, the BTM power may arrive at one or more of the flexible datacenters 220 as DC power. As such, the flexible datacenters 220 may use the DC power to power computing systems. In some such examples, the DC power may be routed through a DC-to-DC converter that is part of power equipment 220B and/or flexible datacenter 220.

In some configurations, a flexible datacenter 220 may be arranged to only have access to power received behind-the-meter from a generation station 202. In the arrangement of FIG. 2, the flexible datacenters 220 may be arranged only with a connection to the generation station 202 and depend solely on power received behind-the-meter from the generation station 202. Alternatively or additionally, the flexible datacenters 220 may receive power from energy storage system 218.

In some configurations, one or more of the flexible datacenters 220 can be arranged to have connections to multiple sources that are capable of supplying power to a flexible datacenter 220. To illustrate a first example, the flexible datacenters 220 are shown connected to connector 242, which can be connected or disconnected via switches to



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the energy storage system 218 via connector 218A, the generation station 202 via bus 240B, and grid power via metered connector 256A. In one embodiment, the flexible datacenters 220 may selectively use power received behind-the-meter from the generation station 202, stored power supplied by the energy storage system 218, and/or grid power. For instance, flexible datacenters 220 may use power stored in the energy storage system 218 when costs for using power supplied behind-the-meter from the generation station 202 are disadvantageous. By having access to the energy storage system 218 available, the flexible datacenters 220 may use the stored power and allow the generation station 202 to subsequently refill the energy storage system 218 when cost for power behind-the-meter is low. Alternatively, the flexible datacenters 220 may use power from multiple sources simultaneously to power different components (e.g., a first set and a second set of computing systems). Thus, the flexible datacenters 220 may leverage the multiple connections in a manner that can reduce the cost for power used by the computing systems at the flexible datacenters 220. The flexible datacenters 220 control system or the remote master control system 262 may monitor power conditions and other factors to determine whether the flexible datacenters 220 should use power from either the generation station 202, grid power, the energy storage system 218, none of the sources, or a subset of sources during a given time range. Other arrangements are possible as well. For example, the arrangement of FIG. 2 illustrates each flexible datacenter 220 as connected via a single connector 242 to energy storage system 218, generation station 202, and metered grid power via 256A. However, one or more flexible datacenters 220 may have independent switched connections to each energy source, allowing the one or more flexible datacenters 220 to operate from different energy sources than other flexible datacenters 220 at the same time.

The selection of which power source to use at a flexible datacenter (e.g., the flexible datacenters 220) or another type of BTM load can change based on various factors, such as the cost and availability of power from both sources, the type of computing systems using the power at the flexible datacenters 220 (e.g., some systems may require a reliable source of power for a long period), the nature of the computational operations being performed at the flexible datacenters 220 (e.g., a high priority task may require immediate completion regardless of cost), and temperature and weather conditions, among other possible factors. As such, a datacenter control system at the flexible datacenters 220, the remote master control system 262, or another entity (e.g., an operator at the generation station 202) may also influence and/or determine the source of power that the flexible datacenters 220 use at a given time to complete computational operations.

In some example embodiments, the flexible datacenters 220 may use power from the different sources to serve different purposes. For example, the flexible datacenters 220 may use metered power from grid power to power one or more systems at the flexible datacenters 220 that are configured to be always-on (or almost always on), such as a control and/or communication system and/or one or more computing systems (e.g., a set of computing systems performing highly important computational operations). The flexible datacenters 220 may use BTM power to power other components within the flexible datacenters 220, such as one or more computing systems that perform less critical computational operations.

In some examples, one or more flexible datacenters 220 may be deployed at the generation station 202. In other

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examples, flexible datacenters 220 may be deployed at a location geographically remote from the generation station 202, while still maintaining a BTM power connection to the generation station 202.

In another example arrangement, the generation station 202 may be connected to a first BTM load (e.g., a flexible datacenter 220) and may supply power to additional BTM loads via connections between the first BTM load and the additional BTM loads (e.g., a connection between a flexible datacenter 220 and another flexible datacenter 220).

The arrangement in FIG. 2, and components included therein, are for non-limiting illustration purposes and other arrangements are contemplated in examples. For instance, in another example embodiment, the arrangement of FIG. 2 may include more or fewer components, such as more BTM loads, different connections between power sources and loads, and/or a different number of datacenters. In addition, some examples may involve one or more components within the arrangement of FIG. 2 being combined or further divided.

Within the arrangement of FIG. 2, a control system, such as the remote master control system 262 or another component (e.g., a control system associated with the grid operator, the generation station control system 216, or a datacenter control system associated with a traditional datacenter or one or more flexible datacenters) may use information to efficiently manage various operations of some of the components within the arrangement of FIG. 2. For example, the remote master control system 262 or another component may manage distribution and execution of computational operations at one or more traditional datacenters 260 and/or flexible datacenters 220 via one or more information-processing algorithms. These algorithms may utilize past and current information in real-time to manage operations of the different components. These algorithms may also make some predictions based on past trends and information analysis. In some examples, multiple computing systems may operate as a network to process information.

Information used to make decisions may include economic and/or power-related information, such as monitored power system conditions. Monitored power system conditions may include one or more of excess power generation at a generation station 202, excess power at a generation station 202 that a connected grid cannot receive, power generation at a generation station 202 subject to economic curtailment, power generation at a generation station 202 subject to reliability curtailment, power generation at a generation station 202 subject to power factor correction, low power generation at a generation station 202, start up conditions at a generation station 202, transient power generation conditions at a generation station 202, or testing conditions where there is an economic advantage to using behind-the-meter power generation at a generation station 202. These different monitored power system conditions can be weighted differently during processing and analysis.

In some examples, the information can include the cost for power from available sources (e.g., BTM power at the generation station 202 versus metered grid power) to enable comparisons to be made which power source costs less. In some instances, the information may include historic prices for power to enable the remote master control system 262 or another system to predict potential future prices in similar situations (e.g., the cost of power tends to trend upwards for grid power during warmer weather and peak-use hours). The information may also indicate the availability of power from the various sources (e.g., BTM power at the generation



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station 262, the energy storage system 218 at the generation station 262, and/or metered grid power).

In addition, the information may also include other data, including information associated with operations at components within the arrangement. For instance, the information may include data associated with performance of operations at the flexible datacenters 220 and the traditional datacenters 260, such as the number of computational tasks currently being performed, the types of tasks being performed (e.g., type of computational operation, time-sensitivity, etc.), the number, types, and capabilities of available computing systems, the amount of computational tasks awaiting performance, and the types of computing systems at one or more datacenters, among others. The information may also include data specifying the conditions at one or more datacenters (e.g., whether or not the temperatures are in a desired range, the amount of power available within an energy storage system such as 218), the amount of computational tasks awaiting performance in the queue of one or more of the datacenters, and the identities of the entities associated with the computational operations at one or more of the datacenters. Entities associated with computational operations may be, for example, owners of the datacenters, customers who purchase computational time at the datacenters, or other entities.

The information used by the remote master control system 262 or another component may include data associated with the computational operations to be performed, such as deadlines, priorities (e.g., high vs. low priority tasks), cost to perform based on required computing systems, the optimal computing systems (e.g., CPU vs GPU vs ASIC; processing unit capabilities, speeds, or frequencies, or instructional sets executable by the processing units) for performing each requested computational task, and prices each entity (e.g., company) is willing to pay for computational operations to be performed or otherwise supported via computing systems at a traditional datacenter 260 or a flexible datacenter 220, among others. In addition, the information may also include other data (e.g., weather conditions at locations of datacenters or power sources, any emergencies associated with a datacenter or power source, or the current value of bids associated with an auction for computational tasks).

The information may be updated in-real time and used to make the different operational decisions within the arrangement of FIG. 2. For instance, the information may help a component (e.g., the remote master control system 262 or a control system at a flexible datacenter 220) determine when to ramp up or ramp down power use at a flexible datacenter 220 or when to switch one or more computing systems at a flexible datacenter 220 into a low power mode or to operate at a different frequency, among other operational adjustments. The information can additionally or alternatively help a component within the arrangement of FIG. 2 to determine when to transfer computational operations between computing systems or between datacenters based on various factors. In some instances, the information may also be used to determine when to temporarily stop performing a computational operation or when to perform a computational operation at multiple sites for redundancy or other reasons. The information may further be used to determine when to accept new computational operations from entities or when to temporarily suspend accepting new tasks to be performed due to lack of computing system availability.

The remote master control system 262 represents a computing system that is capable of obtaining, managing, and using the information described above to manage and over-

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see one or more operations within the arrangement of FIG. 2. As such, the remote master control system 262 may be one or more computing systems configured to process all, or a subset of, the information described above, such as power, environment, computational characterization, and economic factors to assist with the distribution and execution of computing operations among one or more datacenters. For instance, the remote master control system 262 may be configured to obtain and delegate computational operations among one or more datacenters based on a weighted analysis of a variety of factors, including one or more of the cost and availability of power, the types and availability of the computing systems at each datacenter, current and predicted weather conditions at the different locations of flexible datacenters (e.g., flexible datacenters 220) and generation stations (e.g., generation stations 202), levels of power storage available at one or more energy storage systems (e.g., energy storage system 218), and deadlines and other attributes associated with particular computational operations, among other possible factors. As such, the analysis of information performed by the remote master control system 262 may vary within examples. For instance, the remote master control system 262 may use real-time information to determine whether or not to route a computational operation to a particular flexible datacenter (e.g., a flexible datacenter 220) or to transition a computational operation between datacenters (e.g., from traditional datacenter 260 to a flexible datacenter 220).

As shown in FIG. 2, the generation station 202 may be able to supply power to the grid and/or BTM loads such as flexible datacenters 220. With such a configuration, the generation station 202 may selectively provide power to the BTM loads and/or the grid based on economic and power availability considerations. For example, the generation station 202 may supply power to the grid when the price paid for the power exceeds a particular threshold (e.g., the power price offered by operators of the flexible datacenters 220). In some instances, the operator of a flexible datacenter and the operator of a generation station capable of supplying BTM power to the flexible datacenter may utilize a predefined arrangement (e.g., a contract) that specifies a duration and/or price range when the generation station may supply power to the flexible datacenter.

The remote master control system 262 may be capable of directing one or more flexible datacenters 220 to ramp-up or ramp-down to desired power consumption levels, and/or to control cooperative action of multiple flexible datacenters by determining how to power each individual flexible datacenter 220 in accordance with operational directives.

The configuration of the remote master control system 262 can vary within examples as further discussed with respect to FIGS. 2, 3, and 7-9. The remote master control system 262 may operate as a single computing system or may involve a network of computing systems. Preferably, the remote master control system 262 is implemented across one or more servers in a fault-tolerant operating environment that ensures continuous uptime and connectivity by virtue of its distributed nature. Alternatively, although the remote master control system 262 is shown as a physically separate component arrangement for FIG. 2, the remote master control system 262 may be combined with another component in other embodiments. To illustrate an example, the remote master control system 262 may operate as part of a flexible datacenter (e.g., a computing system or a datacenter control system of the flexible datacenter 220), includ-



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ing sharing components with a flexible datacenter, sharing power with a flexible datacenter, and/or being co-located with a flexible datacenter.

In addition, the remote master control system 262 may communicate with components within the arrangement of FIG. 2 using various communication technologies, including wired and wireless communication technologies. For instance, the remote master control system 262 may use wired (not illustrated) or wireless communication to communicate with datacenter control systems or other computing systems at the flexible datacenters 220 and the traditional datacenters 260. The remote master control system 262 may also communicate with entities inside or outside the arrangement of FIG. 2 and other components within the arrangement of FIG. 2 via wired or wireless communication. For instance, the remote master control system 262 may use wireless communication to obtain computational operations from entities seeking support for the computational operations at one or more datacenters in exchange for payment. The remote master control system 262 may communicate directly with the entities or may obtain the computational operations from the traditional datacenters 260. For instance, an entity may submit jobs (e.g., computational operations) to one or more traditional datacenters 260. The remote master control system 262 may determine that transferring one or more of the computational operations to a flexible datacenter 220 may better support the transferred computational operations. For example, the remote master control system 262 may determine that the transfer may enable the computational operations to be completed quicker and/or at a lower cost. In some examples, the remote master control system 262 may communicate with the entity to obtain approval prior to transferring the one or more computational operations.

The remote master control system 262 may also communicate with grid operators and/or an operator of generation station 202 to help determine power management strategies when distributing computational operations across the various datacenters. In addition, the remote master control system 262 may communicate with other sources, such as weather prediction systems, historical and current power price databases, and auction systems, etc.

In further examples, the remote master control system 262 or another computing system within the arrangement of FIG. 2 may use wired or wireless communication to submit bids within an auction that involves a bidder (e.g., the highest bid) obtaining computational operations or other tasks to be performed. Particularly, the remote master control system 262 may use the information discussed above to develop bids to obtain computing operations for performance at available computing systems at flexible datacenters (e.g., flexible datacenters 220).

In the example arrangement shown in FIG. 2, the flexible datacenters 220 represent example loads that can receive power behind-the-meter from the generation station 202. In such a configuration, the flexible datacenters 220 may obtain and utilize power behind-the-meter from the generation station 202 to perform various computational operations. Performance of a computational operation may involve one or more computing systems providing resources useful in the computational operation. For instance, the flexible datacenters 220 may include one or more computing systems configured to store information, perform calculations and/or parallel processes, perform simulations, mine cryptocurrencies, and execute applications, among other potential tasks. The computing systems can be specialized or generic and can be arranged at each flexible datacenter 220 in a variety

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of ways (e.g., straight configuration, zig-zag configuration) as further discussed with respect to FIGS. 6A, 6B. Furthermore, although the example arrangement illustrated in FIG. 2 shows configurations where flexible datacenters 220 serve as BTM loads, other types of loads can be used as BTM loads within examples.

The arrangement of FIG. 2 includes the traditional datacenters 260 coupled to metered grid power. The traditional datacenters 260 using metered grid power to provide computational resources to support computational operations. One or more enterprises may assign computational operations to the traditional datacenters 260 with expectations that the datacenters reliably provide resources without interruption (i.e., non-intermittently) to support the computational operations, such as processing abilities, networking, and/or volatile storage. Similarly, one or more enterprises may also request computational operations to be performed by the flexible datacenters 220. The flexible datacenters 220 differ from the traditional datacenters 260 in that the flexible datacenters 220 are arranged and/or configured to be connected to BTM power, are expected to operate intermittently, and are expected to ramp load (and thus computational capability) up or down regularly in response to control directives. In some examples, the flexible datacenters 220 and the traditional datacenters 260 may have similar configurations and may only differ based on the source(s) of power relied upon to power internal computing systems. Preferably, however, the flexible datacenters 220 include particular fast load ramping abilities (e.g., quickly increase or decrease power usage) and are intended and designed to effectively operate during intermittent periods of time.

FIG. 3 shows a block diagram of the remote master control system 300 according to one or more example embodiments. Remote master control system 262 may take the form of remote master control system 300, or may include less than all components in remote master control system 300, different components than in remote master control system 300, and/or more components than in remote master control system 300.

The remote master control system 300 may perform one or more operations described herein and may include a processor 302, a data storage unit 304, a communication interface 306, a user interface 308, an operations and environment analysis module 310, and a queue system 312. In other examples, the remote master control system 300 may include more or fewer components in other possible arrangements.

As shown in FIG. 3, the various components of the remote master control system 300 can be connected via one or more connection mechanisms (e.g., a connection mechanism 314). In this disclosure, the term "connection mechanism" means a mechanism that facilitates communication between two or more devices, systems, components, or other entities. For instance, a connection mechanism can be a simple mechanism, such as a cable, PCB trace, or system bus, or a relatively complex mechanism, such as a packet-based communication network (e.g., LAN, WAN, and/or the Internet). In some instances, a connection mechanism can include a non-tangible medium (e.g., where the connection is wireless).

As part of the arrangement of FIG. 2, the remote master control system 300 (corresponding to remote master control system 262) may perform a variety of operations, such as management and distribution of computational operations among datacenters, monitoring operational, economic, and environment conditions, and power management. For instance, the remote master control system 300 may obtain



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computational operations from one or more enterprises for performance at one or more datacenters. The remote master control system 300 may subsequently use information to distribute and assign the computational operations to one or more datacenters (e.g., the flexible datacenters 220) that have the resources (e.g., particular types of computing systems and available power) available to complete the computational operations. In some examples, the remote master control system 300 may assign all incoming computational operation requests to the queue system 312 and subsequently assign the queued requests to computing systems based on an analysis of current market and power conditions.

Although the remote master control system 300 is shown as a single entity, a network of computing systems may perform the operations of the remote master control system 300 in some examples. For example, the remote master control system 300 may exist in the form of computing systems (e.g., datacenter control systems) distributed across multiple datacenters.

The remote master control system 300 may include one or more processors 302. As such, the processor 302 may represent one or more general-purpose processors (e.g., a microprocessor) and/or one or more special-purpose processors (e.g., a digital signal processor (DSP)). In some examples, the processor 302 may include a combination of processors within examples. The processor 302 may perform operations, including processing data received from the other components within the arrangement of FIG. 2 and data obtained from external sources, including information such as weather forecasting systems, power market price systems, and other types of sources or databases.

The data storage unit 304 may include one or more volatile, non-volatile, removable, and/or non-removable storage components, such as magnetic, optical, or flash storage, and/or can be integrated in whole or in part with the processor 302. As such, the data storage unit 304 may take the form of a non-transitory computer-readable storage medium, having stored thereon program instructions (e.g., compiled or non-compiled program logic and/or machine code) that, when executed by the processor 302, cause the remote master control system 300 to perform one or more acts and/or functions, such as those described in this disclosure. Such program instructions can define and/or be part of a discrete software application. In some instances, the remote master control system 300 can execute program instructions in response to receiving an input, such as from the communication interface 306, the user interface 308, or the operations and environment analysis module 310. The data storage unit 304 may also store other information, such as those types described in this disclosure.

In some examples, the data storage unit 304 may serve as storage for information obtained from one or more external sources. For example, data storage unit 304 may store information obtained from one or more of the traditional datacenters 260, a generation station 202, a system associated with the grid, and flexible datacenters 220. As examples only, data storage 304 may include, in whole or in part, local storage, dedicated server-managed storage, network attached storage, and/or cloud-based storage, and/or combinations thereof.

The communication interface 306 can allow the remote master control system 300 to connect to and/or communicate with another component according to one or more protocols. For instance, the communication interface 306 may be used to obtain information related to current, future, and past prices for power, power availability, current and predicted

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weather conditions, and information regarding the different datacenters (e.g., current workloads at datacenters, types of computing systems available within datacenters, price to obtain power at each datacenter, levels of power storage available and accessible at each datacenter, etc.). In an example, the communication interface 306 can include a wired interface, such as an Ethernet interface or a high-definition serial-digital-interface (HD-SDI). In another example, the communication interface 406 can include a wireless interface, such as a cellular, satellite, WiMAX, or WI-FI interface. A connection can be a direct connection or an indirect connection, the latter being a connection that passes through and/or traverses one or more components, such as such as a router, switcher, or other network device. Likewise, a wireless transmission can be a direct transmission or an indirect transmission. The communication interface 306 may also utilize other types of wireless communication to enable communication with datacenters positioned at various locations.

The communication interface 306 may enable the remote master control system 300 to communicate with the components of the arrangement of FIG. 2. In addition, the communication interface 306 may also be used to communicate with the various datacenters, power sources, and different enterprises submitting computational operations for the datacenters to support.

The user interface 308 can facilitate interaction between the remote master control system 300 and an administrator or user, if applicable. As such, the user interface 308 can include input components such as a keyboard, a keypad, a mouse, a touch-sensitive panel, a microphone, and/or a camera, and/or output components such as a display device (which, for example, can be combined with a touch-sensitive panel), a sound speaker, and/or a haptic feedback system. More generally, the user interface 308 can include hardware and/or software components that facilitate interaction between remote master control system 300 and the user of the system.

In some examples, the user interface 308 may enable the manual examination and/or manipulation of components within the arrangement of FIG. 2. For instance, an administrator or user may use the user interface 308 to check the status of, or change, one or more computational operations, the performance or power consumption at one or more datacenters, the number of tasks remaining within the queue system 312, and other operations. As such, the user interface 308 may provide remote connectivity to one or more systems within the arrangement of FIG. 2.

The operations and environment analysis module 310 represents a component of the remote master control system 300 associated with obtaining and analyzing information to develop instructions/directives for components within the arrangement of FIG. 2. The information analyzed by the operations and environment analysis module 310 can vary within examples and may include the information described above with respect predicting and/or directing the use of BTM power. For instance, the operations and environment analysis module 310 may obtain and access information related to the current power state of computing systems operating as part of the flexible datacenters 220 and other datacenters that the remote master control system 300 has access to. This information may be used to determine when to adjust power usage or mode of one or more computing systems. In addition, the remote master control system 300 may provide instructions a flexible datacenter 220 to cause a subset of the computing systems to transition into a low power mode to consume less power while still performing



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operations at a slower rate. The remote master control system 300 may also use power state information to cause a set of computing systems at a flexible datacenter 220 to operate at a higher power consumption mode. In addition, the remote master control system 300 may transition computing systems into sleep states or power on/off based on information analyzed by the operations and environment analysis module 310.

In some examples, the operations and environment analysis module 310 may use location, weather, activity levels at the flexible datacenters or the generation station, and power cost information to determine control strategies for one or more components in the arrangement of FIG. 2. For instance, the remote master control system 300 may use location information for one or more datacenters to anticipate potential weather conditions that could impact access to power. In addition, the operations and environment analysis module 310 may assist the remote master control system 300 determine whether to transfer computational operations between datacenters based on various economic and power factors.

The queue system 312 represents a queue capable of organizing computational operations to be performed by one or more datacenters. Upon receiving a request to perform a computational operation, the remote master control system 300 may assign the computational operation to the queue until one or more computing systems are available to support the computational operation. The queue system 312 may be used for organizing and transferring computational tasks in real time.

The organizational design of the queue system 312 may vary within examples. In some examples, the queue system 312 may organize indications (e.g., tags, pointers) to sets of computational operations requested by various enterprises. The queue system 312 may operate as a First-In-First-Out (FIFO) data structure. In a FIFO data structure, the first element added to the queue will be the first one to be removed. As such, the queue system 312 may include one or more queues that operate using the FIFO data structure.

In some examples, one or more queues within the queue system 312 may use other designs of queues, including rules to rank or organize queues in a particular manner that can prioritize some sets of computational operations over others. The rules may include one or more of an estimated cost and/or revenue to perform each set of computational operations, an importance assigned to each set of computational operations, and deadlines for initiating or completing each set of computational operations, among others. Examples using a queue system are further described below with respect to FIG. 9.

In some examples, the remote master control system 300 may be configured to monitor one or more auctions to obtain computational operations for datacenters to support. Particularly, the remote master control system 300 may use resource availability and power prices to develop and submit bids to an external or internal auction system for the right to support particular computational operations. As a result, the remote master control system 300 may identify computational operations that could be supported at one or more flexible datacenters 220 at low costs.

FIG. 4 is a block diagram of a generation station 400, according to one or more example embodiments. Generation station 202 may take the form of generation station 400, or may include less than all components in generation station 400, different components than in generation station 400, and/or more components than in generation station 400. The generation station 400 includes power generation equipment

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401, a communication interface 408, a behind-the-meter interface 406, a grid interface 404, a user interface 410, a generation station control system 414, and power transformation equipment 402. The power generation equipment 210 may take the form of power generation equipment 401, or may include less than all components in power generation equipment 401, different components than in power generation equipment 401, and/or more components than in power generation equipment 401. Generation station control system 216 may take the form of generation station control system 414, or may include less than all components in generation station control system 414, different components than in generation station control system 414, and/or more components than in generation station control system 414. Some or all of the components generation station 400 may be connected via a communication interface 516. These components are illustrated in FIG. 4 to convey an example configuration for the generation station 400 (corresponding to generation station 202 shown in FIG. 2). In other examples, the generation station 400 may include more or fewer components in other arrangements.

The generation station 400 can correspond to any type of grid-connected utility-scale power producer capable of supplying power to one or more loads. The size, amount of power generated, and other characteristics of the generation station 400 may differ within examples. For instance, the generation station 400 may be a power producer that provides power intermittently. The power generation may depend on monitored power conditions, such as weather at the location of the generation station 400 and other possible conditions. As such, the generation station 400 may be a temporary arrangement, or a permanent facility, configured to supply power. The generation station 400 may supply BTM power to one or more loads and supply metered power to the electrical grid. Particularly, the generation station 400 may supply power to the grid as shown in the arrangement of FIG. 2.

The power generation equipment 401 represents the component or components configured to generate utility-scale power. As such, the power generation equipment 401 may depend on the type of facility that the generation station 400 corresponds to. For instance, the power generation equipment 401 may correspond to electric generators that transform kinetic energy into electricity. The power generation equipment 401 may use electromagnetic induction to generate power. In other examples, the power generation equipment 401 may utilize electrochemistry to transform chemical energy into power. The power generation equipment 401 may use the photovoltaic effect to transform light into electrical energy. In some examples, the power generation equipment 401 may use turbines to generate power. The turbines may be driven by, for example, wind, water, steam or burning gas. Other examples of power production are possible.

The communication interface 408 can enable the generation station 400 to communicate with other components within the arrangement of FIG. 2. As such, the communication interface 408 may operate similarly to the communication interface 306 of the remote master control system 300 and the communication interface 503 of the flexible datacenter 500.

The generation station control system 414 may be one or more computing systems configured to control various aspects of the generation station 400.

The BTM interface 406 is a module configured to enable the power generation equipment 401 to supply BTM power to one or more loads and may include multiple components.



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The arrangement of the BTM interface 406 may differ within examples based on various factors, such as the number of flexible datacenters 220 (or 500) coupled to the generation station 400, the proximity of the flexible datacenters 220 (or 500), and the type of generation station 400, among others. In some examples, the BTM interface 406 may be configured to enable power delivery to one or more flexible datacenters positioned near the generation station 400. Alternatively, the BTM interface 406 may also be configured to enable power delivery to one or more flexible datacenters 220 (or 500) positioned remotely from the generation station 400.

The grid interface 404 is a module configured to enable the power generation equipment 401 to supply power to the grid and may include multiple components. As such, the grid interface 404 may couple to one or more transmission lines (e.g., transmission lines 404a shown in FIG. 2) to enable delivery of power to the grid.

The user interface 410 represents an interface that enables administrators and/or other entities to communicate with the generation station 400. As such, the user interface 410 may have a configuration that resembles the configuration of the user interface 308 shown in FIG. 3. An operator may utilize the user interface 410 to control or monitor operations at the generation station 400.

The power transformation equipment 402 represents equipment that can be utilized to enable power delivery from the power generation equipment 401 to the loads and to transmission lines linked to the grid. Example power transformation equipment 402 includes, but is not limited to, transformers, inverters, phase converters, and power conditioners.

FIG. 5 shows a block diagram of a flexible datacenter 500, according to one or more example embodiments. Flexible datacenters 220 may take the form of flexible datacenter 500, or may include less than all components in flexible datacenter 500, different components than in flexible datacenter 500, and/or more components than in flexible datacenter 500. In the example embodiment shown in FIG. 5, the flexible datacenter 500 includes a power input system 502, a communication interface 503, a datacenter control system 504, a power distribution system 506, a climate control system 508, one or more sets of computing systems 512, and a queue system 514. These components are shown connected by a communication bus 528. In other embodiments, the configuration of flexible datacenter 500 can differ, including more or fewer components. In addition, the components within flexible datacenter 500 may be combined or further divided into additional components within other embodiments.

The example configuration shown in FIG. 5 represents one possible configuration for a flexible datacenter. As such, each flexible datacenter may have a different configuration when implemented based on a variety of factors that may influence its design, such as location and temperature that the location, particular uses for the flexible datacenter, source of power supplying computing systems within the flexible datacenter, design influence from an entity (or entities) that implements the flexible datacenter, and space available for the flexible datacenter. Thus, the embodiment of flexible datacenter 220 shown in FIG. 2 represents one possible configuration for a flexible datacenter out of many other possible configurations.

The flexible datacenter 500 may include a design that allows for temporary and/or rapid deployment, setup, and start time for supporting computational operations. For instance, the flexible datacenter 500 may be rapidly

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deployed at a location near a source of generation station power (e.g., near a wind farm or solar farm). Rapid deployment may involve positioning the flexible datacenter 500 at a target location and installing and/or configuring one or more racks of computing systems within. The racks may include wheels to enable swift movement of the computing systems. Although the flexible datacenter 500 could theoretically be placed anywhere, transmission losses may be minimized by locating it proximate to BTM power generation.

The physical construction and layout of the flexible datacenter 500 can vary. In some instances, the flexible datacenter 500 may utilize a metal container (e.g., a metal container 602 shown in FIG. 6A). In general, the flexible datacenter 500 may utilize some form of secure weather-proof housing designed to protect interior components from wind, weather, and intrusion. The physical construction and layout of example flexible datacenters are further described with respect to FIGS. 6A-6B.

Within the flexible datacenter 500, various internal components enable the flexible datacenter 500 to utilize power to perform some form of operations. The power input system 502 is a module of the flexible datacenter 500 configured to receive external power and input the power to the different components via assistance from the power distribution system 506. As discussed with respect to FIG. 2, the sources of external power feeding a flexible datacenter can vary in both quantity and type (e.g., the generation stations 202, 400, grid-power, energy storage systems). Power input system 502 includes a BTM power input sub-system 522, and may additionally include other power input sub-systems (e.g., a grid-power input sub-system 524 and/or an energy storage input sub-system 526). In some instances, the quantity of power input sub-systems may depend on the size of the flexible datacenter and the number and/or type of computing systems being powered. In an example embodiment, the flexible datacenter may use grid power as the primary power supply.

In some embodiments, the power input system 502 may include some or all of flexible datacenter Power Equipment 220B. The power input system 502 may be designed to obtain power in different forms (e.g., single phase or three-phase behind-the-meter alternating current ("AC") voltage, and/or direct current ("DC") voltage). As shown, the power input system 502 includes a BTM power input sub-system 522, a grid power input sub-system 524, and an energy input sub-system 526. These sub-systems are included to illustrate example power input sub-systems that the flexible datacenter 500 may utilize, but other examples are possible. In addition, in some instances, these sub-systems may be used simultaneously to supply power to components of the flexible datacenter 500. The sub-systems may also be used based on available power sources.

In some implementations, the BTM power input sub-system 522 may include one or more AC-to-AC step-down transformers used to step down supplied medium-voltage AC to low voltage AC (e.g., 120V to 600V nominal) used to power computing systems 512 and/or other components of flexible datacenter 500. The power input system 502 may also directly receive single-phase low voltage AC from a generation station as BTM power, from grid power, or from a stored energy system such as energy storage system 218. In some implementations, the power input system 502 may provide single-phase AC voltage to the datacenter control system 504 (and/or other components of flexible datacenter 500) independent of power supplied to computing systems 512 to enable the datacenter control system 504 to perform



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management operations for the flexible datacenter 500. For instance, the grid power input sub-system 524 may use grid power to supply power to the datacenter control system 504 to ensure that the datacenter control system 504 can perform control operations and communicate with the remote master control system 300 (or 262) during situations when BTM power is not available. As such, the datacenter control system 504 may utilize power received from the power input system 502 to remain powered to control the operation of flexible datacenter 500, even if the computational operations performed by the computing system 512 are powered intermittently. In some instances, the datacenter control system 504 may switch into a lower power mode to utilize less power while still maintaining the ability to perform some functions.

The power distribution system 506 may distribute incoming power to the various components of the flexible datacenter 500. For instance, the power distribution system 506 may direct power (e.g., single-phase or three-phase AC) to one or more components within flexible datacenter 500. In some embodiments, the power distribution system 506 may include some or all of flexible datacenter Power Equipment 220B.

In some examples, the power input system 502 may provide three phases of three-phase AC voltage to the power distribution system 506. The power distribution system 506 may controllably provide a single phase of AC voltage to each computing system or groups of computing systems 512 disposed within the flexible datacenter 500. The datacenter control system 504 may controllably select which phase of three-phase nominal AC voltage that power distribution system 506 provides to each computing system 512 or groups of computing systems 512. This is one example manner in which the datacenter control system 504 may modulate power delivery (and load at the flexible datacenter 500) by ramping-up flexible datacenter 500 to fully operational status, ramping-down flexible datacenter 500 to offline status (where only datacenter control system 504 remains powered), reducing load by withdrawing power delivery from, or reducing power to, one or more of the computing systems 512 or groups of the computing systems 512, or modulating power factor correction for the generation station 300 (or 202) by controllably adjusting which phases of three-phase nominal AC voltage are used by one or more of the computing systems 512 or groups of the computing systems 512. The datacenter control system 504 may direct power to certain sets of computing systems based on computational operations waiting for computational resources within the queue system 514. In some embodiments, the flexible datacenter 500 may receive BTM DC power to power the computing systems 512.

One of ordinary skill in the art will recognize that a voltage level of three-phase AC voltage may vary based on an application or design and the type or kind of local power generation. As such, a type, kind, or configuration of the operational AC-to-AC step down transformer (not shown) may vary based on the application or design. In addition, the frequency and voltage level of three-phase AC voltage, single-phase AC voltage, and DC voltage may vary based on the application or design in accordance with one or more embodiments.

As discussed above, the datacenter control system 504 may perform operations described herein, such as dynamically modulating power delivery to one or more of the computing systems 512 disposed within flexible datacenter 500. For instance, the datacenter control system 504 may modulate power delivery to one or more of the computing

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systems 512 based on various factors, such as BTM power availability or an operational directive from a generation station 262 or 300 control system, a remote master control system 262 or 300, or a grid operator. In some examples, the datacenter control system 504 may provide computational operations to sets of computing systems 512 and modulate power delivery based on priorities assigned to the computational operations. For instance, an important computational operation (e.g., based on a deadline for execution and/or price paid by an entity) may be assigned to a particular computing system or set of computing systems 512 that has the capacity, computational abilities to support the computational operation. In addition, the datacenter control system 504 may also prioritize power delivery to the computing system or set of computing systems 512.

In some example, the datacenter control system 504 may further provide directives to one or more computing systems to change operations in some manner. For instance, the datacenter control system 504 may cause one or more computing systems 512 to operate at a lower or higher frequency, change clock cycles, or operate in a different power consumption mode (e.g., a low power mode). These abilities may vary depending on types of computing systems 512 available at the flexible datacenter 500. As a result, the datacenter control system 504 may be configured to analyze the computing systems 512 available either on a periodic basis (e.g., during initial set up of the flexible datacenter 500) or in another manner (e.g., when a new computational operation is assigned to the flexible datacenter 500).

The datacenter control system 504 may also implement directives received from the remote master control system 262 or 300. For instance, the remote master control system 262 or 300 may direct the flexible datacenter 500 to switch into a low power mode. As a result, one or more of the computing systems 512 and other components may switch to the low power mode in response.

The datacenter control system 504 may utilize the communication interface 503 to communicate with the remote master control system 262 or 300, other datacenter control systems of other datacenters, and other entities. As such, the communication interface 503 may include components and operate similar to the communication interface 306 of the remote master control system 300 described with respect to FIG. 4.

The flexible datacenter 500 may also include a climate control system 508 to maintain computing systems 512 within a desired operational temperature range. The climate control system 508 may include various components, such as one or more air intake components, an evaporative cooling system, one or more fans, an immersive cooling system, an air conditioning or refrigerant cooling system, and one or more air outtake components. One of ordinary skill in the art will recognize that any suitable heat extraction system configured to maintain the operation of computing systems 512 within the desired operational temperature range may be used.

The flexible datacenter 500 may further include an energy storage system 510. The energy storage system 510 may store energy for subsequent use by computing systems 512 and other components of flexible datacenter 500. For instance, the energy storage system 510 may include a battery system. The battery system may be configured to convert AC voltage to DC voltage and store power in one or more storage cells. In some instances, the battery system may include a DC-to-AC inverter configured to convert DC

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voltage to AC voltage, and may further include an AC phase-converter, to provide AC voltage for use by flexible datacenter 500.

The energy storage system 510 may be configured to serve as a backup source of power for the flexible datacenter 500. For instance, the energy storage system 510 may receive and retain power from a BTM power source at a low cost (or no cost at all). This low-cost power can then be used by the flexible datacenter 500 at a subsequent point, such as when BTM power costs more. Similarly, the energy storage system 510 may also store energy from other sources (e.g., grid power). As such, the energy storage system 510 may be configured to use one or more of the sub-systems of the power input system 502.

In some examples, the energy storage system 510 may be external to the flexible datacenter 500. For instance, the energy storage system 510 may be an external source that multiple flexible datacenters utilize for back-up power.

The computing systems 512 represent various types of computing systems configured to perform computational operations. Performance of computational operations include a variety of tasks that one or more computing systems may perform, such as data storage, calculations, application processing, parallel processing, data manipulation, cryptocurrency mining, and maintenance of a distributed ledger, among others. As shown in FIG. 5, the computing systems 512 may include one or more CPUs 516, one or more GPUs 518, and/or one or more Application-Specific Integrated Circuits (ASIC's) 520. Each type of computing system 512 may be configured to perform particular operations or types of operations.

Due to different performance features and abilities associated with the different types of computing systems, the datacenter control system 504 may determine, maintain, and/or relay this information about the types and/or abilities of the computing systems, quantity of each type, and availability to the remote master control system 262 or 300 on a routine basis (e.g., periodically or on-demand). This way, the remote master control system 262 or 300 may have current information about the abilities of the computing systems 512 when distributing computational operations for performance at one or more flexible datacenters. Particularly, the remote master control system 262 or 300 may assign computational operations based on various factors, such as the types of computing systems available and the type of computing systems required by each computing operation, the availability of the computing systems, whether computing systems can operate in a low power mode, and/or power consumption and/or costs associated with operating the computing systems, among others.

The quantity and arrangement of these computing systems 512 may vary within examples. In some examples, the configuration and quantity of computing systems 512 may depend on various factors, such as the computational tasks that are performed by the flexible datacenter 500. In other examples, the computing systems 512 may include other types of computing systems as well, such as DSPs, SIMDs, neural processors, and/or quantum processors.

As indicated above, the computing systems 512 can perform various computational operations, including in different configurations. For instance, each computing system may perform a particular computational operation unrelated to the operations performed at other computing systems. Groups of the computing systems 512 may also be used to work together to perform computational operations.

In some examples, multiple computing systems may perform the same computational operation in a redundant

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configuration. This redundant configuration creates a back-up that prevents losing progress on the computational operation in situations of a computing failure or intermittent operation of one or more computing systems. In addition, the computing systems 512 may also perform computational operations using a check point system. The check point system may enable a first computing system to perform operations up to a certain point (e.g., a checkpoint) and switch to a second computing system to continue performing the operations from that certain point. The check point system may also enable the datacenter control system 504 to communicate statuses of computational operations to the remote master control system 262 or 300. This can further enable the remote master control system 262 or 300 to transfer computational operations between different flexible datacenters allowing computing systems at the different flexible datacenters to resume support of computational operations based on the check points.

The queue system 514 may operate similar to the queue system 312 of the remote master control system 300 shown in FIG. 3. Particularly, the queue system 514 may help store and organize computational tasks assigned for performance at the flexible datacenter 500. In some examples, the queue system 514 may be part of a distributed queue system such that each flexible datacenter in a fleet of flexible datacenter includes a queue, and each queue system 514 may be able to communicate with other queue systems. In addition, the remote master control system 262 or 300 may be configured to assign computational tasks to the queues located at each flexible datacenter (e.g., the queue system 514 of the flexible datacenter 500). As such, communication between the remote master control system 262 or 300 and the datacenter control system 504 and/or the queue system 514 may allow organization of computational operations for the flexible datacenter 500 to support.

FIG. 6A shows another structural arrangement for a flexible datacenter, according to one or more example embodiments. The particular structural arrangement shown in FIG. 6A may be implemented at flexible datacenter 500. The illustration depicts the flexible datacenter 500 as a mobile container 702 equipped with the power input system 502, the power distribution system 506, the climate control system 508, the datacenter control system 504, and the computing systems 512 arranged on one or more racks 604. These components of flexible datacenter 500 may be arranged and organized according to an example structural region arrangement. As such, the example illustration represents one possible configuration for the flexible datacenter 500, but others are possible within examples.

As discussed above, the structural arrangement of the flexible datacenter 500 may depend on various factors, such as the ability to maintain temperature within the mobile container 602 within a desired temperature range. The desired temperature range may depend on the geographical location of the mobile container 602 and the type and quantity of the computing systems 512 operating within the flexible datacenter 500 as well as other possible factors. As such, the different design elements of the mobile container 602 including the inner contents and positioning of components may depend on factors that aim to maximize the use of space within mobile container 602, lower the amount of power required to cool the computing systems 512, and make setup of the flexible datacenter 500 efficient. For instance, a first flexible datacenter positioned in a cooler geographic region may include less cooling equipment than a second flexible datacenter positioned in a warmer geographic region.



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As shown in FIG. 6A, the mobile container 602 may be a storage trailer disposed on permanent or removable wheels and configured for rapid deployment. In other embodiments, the mobile container 602 may be a storage container (not shown) configured for placement on the ground and potentially stacked in a vertical or horizontal manner (not shown). In still other embodiments, the mobile container 602 may be an inflatable container, a floating container, or any other type or kind of container suitable for housing a mobile flexible datacenter. As such, the flexible datacenter 500 may be rapidly deployed on site near a source of unutilized behind-the-meter power generation. And in still other embodiments, the flexible datacenter 500 might not include a mobile container. For example, the flexible datacenter 500 may be situated within a building or another type of stationary environment.

FIG. 6B shows the computing systems 512 in a straight-line configuration for installation within the flexible datacenter 500, according to one or more example embodiments. As indicated above, the flexible datacenter 500 may include a plurality of racks 604, each of which may include one or more computing systems 512 disposed therein. As discussed above, the power input system 502 may provide three phases of AC voltage to the power distribution system 506. In some examples, the power distribution system 506 may controllably provide a single phase of AC voltage to each computing system 512 or group of computing systems 512 disposed within the flexible datacenter 500. As shown in FIG. 6B, for purposes of illustration only, eighteen total racks 604 are divided into a first group of six racks 606, a second group of six racks 608, and a third group of six racks 610, where each rack contains eighteen computing systems 512. The power distribution system (506 of FIG. 5) may, for example, provide a first phase of three-phase AC voltage to the first group of six racks 606, a second phase of three-phase AC voltage to the second group of six racks 608, and a third phase of three-phase AC voltage to the third group of six racks 610. In other embodiments, the quantity of racks and computing systems can vary.

FIG. 7 shows a control distribution system 700 of the flexible datacenter 500 according to one or more example embodiments. The system 700 includes a grid operator 702, a generation station control system 216, a remote master control system 300, and a flexible datacenter 500. As such, the system 700 represents one example configuration for controlling operations of the flexible datacenter 500, but other configurations may include more or fewer components in other arrangements.

The datacenter control system 504 may independently or cooperatively with one or more of the generation station control system 414, the remote master control system 300, and/or the grid operator 702 modulate power at the flexible datacenter 500. During operations, the power delivery to the flexible datacenter 500 may be dynamically adjusted based on conditions or operational directives. The conditions may correspond to economic conditions (e.g., cost for power, aspects of computational operations to be performed), power-related conditions (e.g., availability of the power, the sources offering power), demand response, and/or weather-related conditions, among others.

The generation station control system 414 may be one or more computing systems configured to control various aspects of a generation station (not independently illustrated, e.g., 216 or 400). As such, the generation station control system 414 may communicate with the remote master

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control system 300 over a networked connection 706 and with the datacenter control system 704 over a networked or other data connection 708.

As discussed with respect to FIGS. 2 and 3, the remote master control system 300 can be one or more computing systems located offsite, but connected via a network connection 710 to the datacenter control system 504. The remote master control system 300 may provide supervisory controls or override control of the flexible datacenter 500 or a fleet of flexible datacenters (not shown).

The grid operator 702 may be one or more computing systems that are configured to control various aspects of the power grid (not independently illustrated) that receives power from the generation station. The grid operator 702 may communicate with the generation station control system 300 over a networked or other data connection 712.

The datacenter control system 504 may monitor BTM power conditions at the generation station and determine when a datacenter ramp-up condition is met. The BTM power availability may include one or more of excess local power generation, excess local power generation that the grid cannot accept, local power generation that is subject to economic curtailment, local power generation that is subject to reliability curtailment, local power generation that is subject to power factor correction, conditions where the cost for power is economically viable (e.g., low cost to obtain power), low priced power, situations where local power generation is prohibitively low, start up situations, transient situations, or testing situations where there is an economic advantage to using locally generated behind-the-meter power generation, specifically power available at little to no cost and with no associated transmission or distribution losses or costs. For example, a datacenter control system may analyze future workload and near term weather conditions at the flexible datacenter.

In some instances, the datacenter ramp-up condition may be met if there is sufficient behind-the-meter power availability and there is no operational directive from the generation station control system 414, the remote master control system 300, or the grid operator 702 to go offline or reduce power. As such, the datacenter control system 504 may enable 714 the power input system 502 to provide power to the power distribution system 506 to power the computing systems 512 or a subset thereof.

The datacenter control system 504 may optionally direct one or more computing systems 512 to perform predetermined computational operations (e.g., distributed computing processes). For example, if the one or more computing systems 512 are configured to perform blockchain hashing operations, the datacenter control system 504 may direct them to perform blockchain hashing operations for a specific blockchain application, such as, for example, Bitcoin, Litecoin, or Ethereum. Alternatively, one or more computing systems 512 may be configured to perform high-throughput computing operations and/or high performance computing operations.

The remote master control system 300 may specify to the datacenter control system 504 what sufficient behind-the-meter power availability constitutes, or the datacenter control system 504 may be programmed with a predetermined preference or criteria on which to make the determination independently. For example, in certain circumstances, sufficient behind-the-meter power availability may be less than that required to fully power the entire flexible datacenter 500. In such circumstances, the datacenter control system 504 may provide power to only a subset of computing systems, or operate the plurality of computing systems in a



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lower power mode, that is within the sufficient, but less than full, range of power that is available. In addition, the computing systems 512 may adjust operational frequency, such as performing more or less processes during a given duration. The computing systems 512 may also adjust internal clocks via over-clocking or under-clocking when performing operations.

While the flexible datacenter 500 is online and operational, a datacenter ramp-down condition may be met when there is insufficient or anticipated to be insufficient, behind-the-meter power availability or there is an operational directive from the generation station control system 414, the remote master control system 300, or the grid operator 702. The datacenter control system 504 may monitor and determine when there is insufficient, or anticipated to be insufficient, behind-the-meter power availability. As noted above, sufficiency may be specified by the remote master control system 300 or the datacenter control system 504 may be programmed with a predetermined preference or criteria on which to make the determination independently.

An operational directive may be based on current dispatch-ability, forward looking forecasts for when behind-the-meter power is, or is expected to be, available, economic considerations, reliability considerations, operational considerations, or the discretion of the generation station control system 414, the remote master control system 300, or the grid operator 702. For example, the generation station control system 414, the remote master control system 300, or the grid operator 702 may issue an operational directive to flexible datacenter 500 to go offline and power down. When the datacenter ramp-down condition is met, the datacenter control system 504 may disable power delivery to the plurality of computing systems (e.g., 512). The datacenter control system 504 may disable 714 the power input system 502 from providing power (e.g., three-phase nominal AC voltage) to the power distribution system 506 to power down the computing systems 512 while the datacenter control system 504 remains powered and is capable of returning service to operating mode at the flexible datacenter 500 when behind-the-meter power becomes available again.

While the flexible datacenter 500 is online and operational, changed conditions or an operational directive may cause the datacenter control system 504 to modulate power consumption by the flexible datacenter 500. The datacenter control system 504 may determine, or the generation station control system 414, the remote master control system 300, or the grid operator 702 may communicate, that a change in local conditions may result in less power generation, availability, or economic feasibility, than would be necessary to fully power the flexible datacenter 500. In such situations, the datacenter control system 504 may take steps to reduce or stop power consumption by the flexible datacenter 500 (other than that required to maintain operation of datacenter control system 504).

Alternatively, the generation station control system 414, the remote master control system 300, or the grid operator 702, may issue an operational directive to reduce power consumption for any reason, the cause of which may be unknown. In response, the datacenter control system 504 may dynamically reduce or withdraw power delivery to one or more computing systems 512 to meet the dictate. The datacenter control system 504 may controllably provide three-phase nominal AC voltage to a smaller subset of computing systems (e.g., 512) to reduce power consumption. The datacenter control system 504 may dynamically reduce the power consumption of one or more computing

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systems by reducing their operating frequency or forcing them into a lower power mode through a network directive.

Similarly, the flexible datacenter 500 may ramp up power consumption based on various conditions. For instance, the datacenter control system 504 may determine, or the generation control system 414, the remote master control system 300, or the grid operator 702 may communicate, that a change in local conditions may result in greater power generation, availability, or economic feasibility. In such situations, the datacenter control system 504 may take steps to increase power consumption by the flexible datacenter 500.

Alternatively, the generation station control system 414, the remote master control system 300, or the grid operator 702, may issue an operational directive to increase power consumption for any reason, the cause of which may be unknown. In response, the datacenter control system 504 may dynamically increase power delivery to one or more computing systems 512 (or operations at the computing systems 512) to meet the dictate. For instance, one or more computing systems 512 may transition into a higher power mode, which may involve increasing power consumption and/or operation frequency.

One of ordinary skill in the art will recognize that datacenter control system 504 may be configured to have a number of different configurations, such as a number or type or kind of the computing systems 512 that may be powered, and in what operating mode, that correspond to a number of different ranges of sufficient and available behind-the-meter power. As such, the datacenter control system 504 may modulate power delivery over a variety of ranges of sufficient and available unutilized behind-the-meter power availability.

FIG. 8 shows a control distribution system 800 of a fleet of flexible datacenters according to one or more example embodiments. The control distribution system 800 of the flexible datacenter 500 shown and described with respect to FIG. 7 may be extended to a fleet of flexible datacenters as illustrated in FIG. 8. For example, a first generation station (not independently illustrated), such as a wind farm, may include a first plurality of flexible datacenters 802, which may be collocated or distributed across the generation station. A second generation station (not independently illustrated), such as another wind farm or a solar farm, may include a second plurality of flexible datacenters 804, which may be collocated or distributed across the generation station. One of ordinary skill in the art will recognize that the number of flexible datacenters deployed at a given station and the number of stations within the fleet may vary based on an application or design in accordance with one or more example embodiments.

The remote master control system 300 may provide directive to datacenter control systems of the fleet of flexible datacenters in a similar manner to that shown and described with respect to FIG. 7, with the added flexibility to make high level decisions with respect to fleet that may be counterintuitive to a given station. The remote master control system 300 may make decisions regarding the issuance of operational directives to a given generation station based on, for example, the status of each generation station where flexible datacenters are deployed, the workload distributed across fleet, and the expected computational demand required for one or both of the expected workload and predicted power availability. In addition, the remote master control system 300 may shift workloads from the first plurality of flexible datacenters 802 to the second plurality of flexible datacenters 804 for any reason, including, for



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example, a loss of BTM power availability at one generation station and the availability of BTM power at another generation station. As such, the remote master control system 300 may communicate with the generation station control systems 806A, 806B to obtain information that can be used to organize and distribute computational operations to the fleets of flexible datacenters 802, 804.

FIG. 9 shows a queue distribution arrangement for a traditional datacenter 902 and a flexible datacenter 500, according to one or more example embodiments. The arrangement of FIG. 9 includes a flexible datacenter 500, a traditional datacenter 902, a queue system 312, a set of communication links 916, 918, 920A, 920B, and the remote master control system 300. The arrangement of FIG. 9 represents an example configuration scheme that can be used to distribute computing operations using a queue system 312 between the traditional datacenter 902 and one or more flexible datacenters. In other examples, the arrangement of FIG. 9 may include more or fewer components in other potential configurations. For instance, the arrangement of FIG. 9 may not include the queue system 312 or may include routes that bypass the queue system 312.

The arrangement of FIG. 9 may enable computational operations requested to be performed by entities (e.g., companies). As such, the arrangement of FIG. 9 may use the queue system 312 to organize incoming computational operations requests to enable efficient distribution to the flexible datacenter 500 and the critical traditional datacenter 902. Particularly, the arrangement of FIG. 9 may use the queue system 312 to organize sets of computational operations thereby increasing the speed of distribution and performance of the different computational operations among datacenters. As a result, the use of the queue system 312 may reduce time to complete operations and reduce costs.

In some examples, one or more components, such as the datacenter control system 504, the remote master control system 300, the queue system 312, or the control system 936, may be configured to identify situations that may arise where using the flexible datacenter 500 can reduce costs or increase productivity of the system, as compared to using the traditional datacenter 902 for computational operations. For example, a component within the arrangement of FIG. 9 may identify when using behind-the-meter power to power the computing systems 512 within the flexible datacenter 500 is at a lower cost compared to using the computing systems 934 within the traditional datacenter 902 that are powered by grid power. Additionally, a component in the arrangement of FIG. 9 may be configured to determine situations when offloading computational operations from the traditional datacenter 902 indirectly (i.e., via the queue system 312) or directly (i.e., bypassing the queue system 312) to the flexible datacenter 500 can increase the performance allotted to the computational operations requested by an entity (e.g., reduce the time required to complete time-sensitive computational operations).

In some examples, the datacenter control system 504 may monitor activity of the computing systems 512 within the flexible datacenter 500 and use the respective activity levels to determine when to obtain computational operations from the queue system 312. For instance, the datacenter control system 504 may analyze various factors prior to requesting or accessing a set of computational operations or an indication of the computational operations for the computing systems 512 to perform. The various factors may include power availability at the flexible datacenter 500 (e.g., either stored or from a BTM source), availability of the computing systems 512 (e.g., percentage of computing systems avail-

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able), type of computational operations available, estimated cost to perform the computational operations at the flexible datacenter 500, cost for power, cost for power relative to cost for grid power, and instructions from other components within the system, among others. The datacenter control system 504 may analyze one or more of the factors when determining whether to obtain a new set of computational operations for the computing systems 512 to perform. In such a configuration, the datacenter control system 504 manages the activity of the flexible datacenter 500, including determining when to acquire new sets of computational operations when capacity among the computing systems 512 permit.

In other examples, a component (e.g., the remote master control system 300) within the system may assign or distribute one or more sets of computational operations organized by the queue system 312 to the flexible datacenter 500. For example, the remote master control system 300 may manage the queue system 312, including the distribution of computational operations organized by the queue system 312 to the flexible datacenter 500 and the traditional datacenter 902. The remote master control system 300 may utilize the information described with respect to the Figures above to determine when to assign computational operations to the flexible datacenter 500.

The traditional datacenter 902 may include a power input system 930, a power distribution system 932, a datacenter control system 936, and a set of computing systems 934. The power input system 930 may be configured to receive power from a power grid and distribute the power to the computing systems 934 via the power distribution system 932. The datacenter control system 936 may monitor activity of the computing systems 934 and obtain computational operations to perform from the queue system 312. The datacenter control system 936 may analyze various factors prior to requesting or accessing a set of computational operations or an indication of the computational operations for the computing systems 934 to perform. A component (e.g., the remote master control system 300) within the arrangement of FIG. 9 may assign or distribute one or more sets of computational operations organized by the queue system 312 to the traditional datacenter 902.

The communication link 916 represents one or more links that may serve to connect the flexible datacenter 500, the traditional datacenter 902, and other components within the system (e.g., the remote master control system 300, the queue system 312—connections not shown). In particular, the communication link 916 may enable direct or indirect communication between the flexible datacenter 500 and the traditional datacenter 902. The type of communication link 916 may depend on the locations of the flexible datacenter 500 and the traditional datacenter 902. Within embodiments, different types of communication links can be used, including but not limited to WAN connectivity, cloud-based connectivity, and wired and wireless communication links.

The queue system 312 represents an abstract data type capable of organizing computational operation requests received from entities. As each request for computational operations are received, the queue system 312 may organize the request in some manner for subsequent distribution to a datacenter. Different types of queues can make up the queue system 312 within embodiments. The queue system 312 may be a centralized queue that organizes all requests for computational operations. As a centralized queue, all incoming requests for computational operations may be organized by the centralized queue.



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In other examples, the queue system 312 may be distributed consisting of multiple queue sub-systems. In the distributed configuration, the queue system 312 may use multiple queue sub-systems to organize different sets of computational operations. Each queue sub-system may be used to organize computational operations based on various factors, such as according to deadlines for completing each set of computational operations, locations of enterprises submitting the computational operations, economic value associated with the completion of computational operations, and quantity of computing resources required for performing each set of computational operations. For instance, a first queue sub-system may organize sets of non-intensive computational operations and a second queue sub-system may organize sets of intensive computational operations. In some examples, the queue system 312 may include queue sub-systems located at each datacenter. This way, each datacenter (e.g., via a datacenter control system) may organize computational operations obtained at the datacenter until computing systems are able to start executing the computational operations. In some examples, the queue system 312 may move computational operations between different computing systems or different datacenters in real-time.

Within the arrangement of FIG. 9, the queue system 312 is shown connected to the remote master control system 300 via the communication link 918. In addition, the queue system 312 is also shown connected to the flexible datacenter via the communication link 920A and to the traditional datacenter 902 via the communication link 920B. The communication links 918, 920A, 920B may be similar to the communication link 916 and can be various types of communication links within examples.

The queue system 312 may include a computing system configured to organize and maintain queues within the queue system 312. In another example, one or more other components of the system may maintain and support queues within the queue system 312. For instance, the remote master control system 300 may maintain and support the queue system 312. In other examples, multiple components may maintain and support the queue system 312 in a distributed manner, such as a blockchain configuration.

In some embodiments, the remote master control system 300 may serve as an intermediary that facilitates all communication between flexible datacenter 500 and the traditional datacenter 902. Particularly, the traditional datacenter 902 or the flexible datacenter 500 might need to transmit communications to the remote master control system 300 in order to communicate with the other datacenter. As also shown, the remote master control system 300 may connect to the queue system 312 via the communication link 918. Computational operations may be distributed between the queue system 312 and the remote master control system 300 via the communication link 918. The computational operations may be transferred in real-time and mid-performance from one datacenter to another (e.g., from the traditional datacenter 902 to the flexible datacenter 500). In addition, the remote master control system 300 may manage the queue system 312, including providing resources to support queues within the queue system 312.

As a result, the remote master control system 300 may offload some or all of the computational operations assigned to the traditional datacenter 902 to the flexible datacenter 500. This way, the flexible datacenter 500 can reduce overall computational costs by using the behind-the-meter power to provide computational resources to assist traditional datacenter 902. The remote master control system 300 may use the queue system 312 to temporarily store and organize the

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offloaded computational operations until a flexible datacenter (e.g., the flexible datacenter 500) is available to perform them. The flexible datacenter 500 consumes behind-the-meter power without transmission or distribution costs, which lowers the costs associated with performing computational operations originally assigned to the traditional datacenter 902. The remote master control system 300 may further communicate with the flexible datacenter 500 via communication link 922 and the traditional datacenter 902 via the communication link 924.

FIG. 10A shows method 1000 of dynamic power consumption at a flexible datacenter using behind-the-meter power according to one or more example embodiments. Other example methods may be used to manipulate the power delivery to one or more flexible datacenters.

In step 1010, the datacenter control system, the remote master control system, or another computing system may monitor behind-the-meter power availability. In some embodiments, monitoring may include receiving information or an operational directive from the generation station control system or the grid operator corresponding to behind-the-meter power availability.

In step 1020, the datacenter control system or the remote master control system 300 may determine when a datacenter ramp-up condition is met. In some embodiments, the datacenter ramp-up condition may be met when there is sufficient behind-the-meter power availability and there is no operational directive from the generation station to go offline or reduce power.

In step 1030, the datacenter control system may enable behind-the-meter power delivery to one or more computing systems. In some instances, the remote master control system may directly enable BTM power delivery to computing systems within the flexible system without instructing the datacenter control system.

In step 1040, once ramped-up, the datacenter control system or the remote master control system may direct one or more computing systems to perform predetermined computational operations. In some embodiments, the predetermined computational operations may include the execution of one or more distributed computing processes, parallel processes, and/or hashing functions, among other types of processes.

While operational, the datacenter control system, the remote master control system, or another computing system may receive an operational directive to modulate power consumption. In some embodiments, the operational directive may be a directive to reduce power consumption. In such embodiments, the datacenter control system or the remote master control system may dynamically reduce power delivery to one or more computing systems or dynamically reduce power consumption of one or more computing systems. In other embodiments, the operational directive may be a directive to provide a power factor correction factor. In such embodiments, the datacenter control system or the remote master control system may dynamically adjust power delivery to one or more computing systems to achieve a desired power factor correction factor. In still other embodiments, the operational directive may be a directive to go offline or power down. In such embodiments, the datacenter control system may disable power delivery to one or more computing systems.

FIG. 10B shows method 1050 of dynamic power delivery to a flexible datacenter using behind-the-meter power according to one or more embodiments. In step 1060, the datacenter control system or the remote master control system may monitor behind-the-meter power availability. In



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certain embodiments, monitoring may include receiving information or an operational directive from the generation station control system or the grid operator corresponding to behind-the-meter power availability.

In step 1070, the datacenter control system or the remote master control system may determine when a datacenter ramp-down condition is met. In certain embodiments, the datacenter ramp-down condition may be met when there is insufficient behind-the-meter power availability or anticipated to be insufficient behind-the-meter power availability or there is an operational directive from the generation station to go offline or reduce power.

In step 1080, the datacenter control system may disable behind-the-meter power delivery to one or more computing systems. In step 1090, once ramped-down, the datacenter control system remains powered and in communication with the remote master control system so that it may dynamically power the flexible datacenter when conditions change.

One of ordinary skill in the art will recognize that a datacenter control system may dynamically modulate power delivery to one or more computing systems of a flexible datacenter based on behind-the-meter power availability or an operational directive. The flexible datacenter may transition between a fully powered down state (while the datacenter control system remains powered), a fully powered up state, and various intermediate states in between. In addition, flexible datacenter may have a blackout state, where all power consumption, including that of the datacenter control system is halted. However, once the flexible datacenter enters the blackout state, it will have to be manually rebooted to restore power to datacenter control system. Generation station conditions or operational directives may cause flexible datacenter to ramp-up, reduce power consumption, change power factor, or ramp-down.

FIG. 11 illustrates a block diagram of a system for implementing control strategies based on a power option agreement, according to one or more embodiments. The system 1100 represents an example arrangement that includes a control system (e.g., the remote master control system 262), a load (e.g., one or more of the datacenters 1102, 1104, and 1106), and a power entity 1140, which may establish and operate in accordance with a power option agreement. Additional arrangements are possible within examples.

In general, a power option agreement is an agreement between a power entity 1140 associated with the delivery of power to a load (e.g., a grid operator, power generation station, or local control station) and the load (e.g., the datacenters 1102-1106). As part of the power option agreement, the load (e.g., load operator, contracting agent for the load, semi-automated control system associated with the load, and/or automated control system associated with the load) provides the power entity 1140 with the right, but not obligation, to reduce the amount of power delivered (e.g., grid power) to the load up to an agreed amount of power during an agreed upon time interval. In order to provide the power entity 1140 with this option, the load needs to be using at least the amount of power subject to the option (e.g., a minimum power threshold). For instance, the load may agree to use at least 1 MW of grid power at all times during a specified 24-hour time interval to provide the power entity 1140 with the option of being able to reduce the amount of power delivered to the load by any amount up to 1 MW at any point during the specified 24-hour time interval. The load may grant the power entity 1140 with this option in exchange for a monetary consideration (e.g., receive power

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at a reduced price and/or monetary payment if the option is exercised by the power entity).

The power option agreement may be used by the power entity 1140 to reserve the right to reduce the amount of grid power delivered to the load during a set time frame (e.g., the next 24 hours). For instance, the power entity 1140 may exercise a predefined power option to reduce the amount of grid power delivered to the load during a time when the grid power may be better redirected to other loads coupled to the power grid. As such, the power entity 1140 may exercise power option agreements to balance loads coupled to the power grid. In some embodiments, a power option agreement may also specify other parameters, such as costs associated with different levels of power consumption and/or maximum power thresholds for the load to operate according to.

To illustrate an example, a power option agreement may specify that a load (e.g., the datacenters 1102-1106) is required to use at least 10 MW or more at all times during the next 12 hours. Thus, the minimum power threshold according to the power option agreement is 10 MW and this minimum power threshold extends across the time interval of the next 12 hours. In order to comply with the agreement, the load must subsequently operate using 10 MW or more power at all times during the next 12 hours. This way, the load can accommodate a situation where the power entity 1140 exercises the option. Particularly, exercising the option may trigger the load to reduce the amount of power it consumes by an amount up to 10 MW at any point during the 12 hour interval. By establishing this power option agreement, the power entity 1140 can manipulate the amount of power consumed at the load during the next 12 hours by up to 10 MW if power needs to be redirected to another load or a reduction in power consumption is needed for other reasons.

In the example arrangement of the system 1100 shown in FIG. 11, one or more of the datacenters (e.g., the flexible datacenters 1102, 1104, and the traditional datacenter 1106) may operate as the load that is subject to a power option agreement. As the load that is subject to the power option agreement, the datacenters 1102-1106 may execute control instructions in accordance with power target consumption targets that meet or exceed the minimum power thresholds based on the power option agreement.

As shown in FIG. 11, each datacenter 1102-1106 may include a set of computing systems configured to perform computational operations using power from one or more power sources (e.g., BTM power, grid power, and/or grid power subject to a power option agreement). In particular, the flexible datacenter 1102 includes computing systems 1108 arranged into a first set 1114A, a second set 1114B, and a third set 1114C, the flexible datacenter 1104 includes computing systems 1110 arranged into a first set 1116A, a second set 1116B, and a third set 1116B, and the traditional datacenter 1106 includes computing systems 1112 arranged into a first set 1118A, a second set 1118B, and a third set 1118C. Each set of computing systems may include various types of computing systems that can operate in one or more modes.

The different sets of computing systems as well as the multiple datacenters are included in FIG. 11 for illustration purposes. In particular, the variety of computing systems represent different configurations that a load may take while operating in accordance with a power option agreement, and each configuration (as detailed herein) may include ramping up or down power consumption and transferring and performing computational operations between sets of comput-



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ing systems and/or datacenters. In other examples, the load that is subject to a power option agreement may take on other configurations (e.g., a single datacenter **1102-1106**, and/or a single set of computing systems).

The remote master control system **262** may serve as a control system that can determine performance strategies and provide control instructions to the load (e.g., one or more of the datacenters **1102-1106**). In particular, the remote master control system **262** can monitor conditions in concert with the minimum power thresholds and time intervals (e.g., power option data) set forth in, and/or derived from, one or more power option agreements to determine performance strategies that can enable the load to meet the expectations of the power option agreement(s) while also efficiently using power to accomplish computational operations. In some instances, the remote master control system **262** may also be subject to the power option agreement and may adjust its own power consumption based on the power option agreement (e.g., ramp up or down power consumption based on the defined minimum power thresholds during time intervals).

To establish a power option agreement, the remote master control system **262** (or another computing system) may communicate with the power entity **1140**. For instance, the remote master control system **262** may provide a request (e.g., a signal and/or a bid) to the power entity **1140** and receive the terms of one or more power option agreements, or power option data related to power option agreements (e.g., data such as minimum power thresholds and time intervals, but not all terms contained within a potential power option agreement) in response. In some examples, the remote master control system **262** may evaluate one or more conditions prior to establishing a power option agreement to ensure that the conditions could enable the load (e.g., the datacenters **1102-1106**) to operate in accordance with the power option agreement. For instance, the remote master control system **262** may check the quantity and deadlines associated with computational operations assigned to specific datacenters prior to establishing specific datacenters as a load subject to a power option agreement. In some cases, multiple power option agreements may be established. For example, each datacenter **1102-1106** may be subject to a different power option agreement, which may result in the remote master control system **262** managing the power consumption at each of the datacenters **1102-1106** differently.

Within the system **1100** shown in FIG. **11**, the power entity **1140** may represent any type of power entity associated with the delivery of power to the load that is subject to a power option agreement. For instance, the power entity **1140** may be a local station control system, a grid operator, or a power generation source. As such, the power entity **1140** may establish power option agreements with the loads via communication with the loads and/or the remote master control system **262**. For example, the power entity **1140** may obtain and accept a bid from a load trying to engage in a power option agreement with the power entity **1140**. The power entity **1140** is shown with a power option module **1142**, which may be used to establish power option agreements (e.g., fixed-duration **1144** and/or dynamic **1146**).

Once a power option agreement is established, the remote master control system **262** may obtain power option data from the power entity **1140** (or another source) that specifies the power and time expectations of the power entity **1140**. As shown in FIG. **11**, the power entity **1140** includes a power option module **1142**, which may be used to provide power option data to the remote master control system **262** and/or

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the datacenters **1102-1106**. In particular, the power option data may specify the minimum power threshold or thresholds associated with one or more time intervals for the load to operate at in accordance with based on the power option agreement. The power option data may also specify other constraints that the load should operate in accordance with.

In some examples, the power option data may also include an indication of a monetary penalty that would be imposed upon the load for failure to operate as agreed upon for the power option agreement. In addition, the power option data may also include an indication of a monetary benefit provided to the load operating at power consumption levels that are in accordance with a power option agreement. For instance, monetary benefits could include reduced prices for power, credits for power, and/or monetary payments. In addition, the power option data may include further constraints upon power use, such as one or more maximum power thresholds and corresponding time intervals for the maximum power thresholds.

In some embodiments, the power entity **1140** may correspond to a qualified scheduling entity (QSE). A QSE may submit bids and offers on behalf of resource entities (REs) or load serving entities (LSEs), such as retail electric providers (REPs). QSEs may submit offers to sell and/or bids to buy power (energy) in the Day-Ahead Market (e.g., the next 24 hours) and the Real-Time Market. As such, the remote master control system **262** or another computing system may communicate with one or more QSEs to engage and control one or more loads in accordance with one or more power option agreements.

In some examples, a power option agreement may take the form of a fixed duration power option agreement **1144**. The fixed duration power option agreement **1144** may specify a set of minimum power thresholds and a set of time intervals in advance for an upcoming fixed duration of time covered by the agreement. Each minimum power threshold in the set of minimum power thresholds may be associated with a time interval in the set of time intervals. Examples of such association are provided in FIG. **12**. The fixed duration power option agreement may be established in advanced of the time period covered by the set of time intervals to enable the remote master control system **262** to prepare performance strategies for the load (e.g., the datacenter(s)) associated with the power option agreement. Thus, the remote master control system **262** may evaluate the fixed duration power option and other monitored conditions to determine performance strategies for a set of computing systems (e.g., one or more datacenters) during the different intervals that satisfy the minimum power thresholds.

In other examples, a power option agreement may take the form of a dynamic power option agreement **1146**. For a dynamic power option agreement **1146**, minimum power thresholds may be provided to the remote master control system **262** in real-time (or near real-time). For instance, a dynamic power option agreement may specify that the power entity **1140** may provide adjustments to minimum power thresholds and corresponding time intervals in real-time to the remote master control system **262**. For example, a dynamic power option agreement may provide power option data that specifies a minimum power threshold for immediate adjustments (e.g., for the next hour).

In an embodiment, a dynamic power option agreement **1146** may involve repeat communication between the remote master control system **262** and the power entity **1140**. Particularly, the power entity **1140** may provide signals to the remote master control system **262** that request power consumption adjustments to be initiated at one or more



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datacenters by the remote master control system 262 over short time intervals, such as across minutes or seconds. For example, the power entity 1140 may communicate to the remote master control system 262 to ramp power consumption down to a particular level within the next 5 minutes. As a result, the remote master control system 262 may provide instructions to one or more datacenters to ramp down power consumption using a linear ramp over the next 5 minutes to meet the particular level specified by the power entity 1140. The remote master control system 262 may monitor the linear ramp down of power consumption and increase or decrease the rate that the datacenter(s) ramp down power use based on projections and updates received from the power entity 1140. As a result, although the ramp down of power consumption may initially be performed in a linear manner to meet a power target threshold, the remote master control system 262 may adjust the rate of power consumption decrease based on updates from the power entity 1140. For example, 25 percent of the overall power consumption ramp down may occur during a first period (e.g., 4 minutes 30 seconds) of the 5 minutes and the remaining 75 percent of the overall power consumption ramp down may occur during the remaining period of the 5 minutes (e.g., the final 30 seconds). The example percentages are included for illustration purposes and can vary within examples based on various parameters, such as additional communication (e.g., adjustments) provided by the power entity 1140.

In further examples, a power option agreement may operate similarly to both a fixed-duration 1144 and a dynamic power option agreement 1146. Particularly, power option data specifying minimum power thresholds and corresponding time intervals may be provided in advance for the entire fixed-duration of time (e.g., the next 24 hours). Additional power option data may then be subsequently provided enabling the remote master control system 262 to make one or more adjustments to accommodate any changes specified within the additional power option data. For instance, additional power option data may indicate that a power entity exercised its option to deliver less power to the load. As a result, the remote master control system may instruct the load to adjust power consumption based on the power entity reducing the power threshold minimum via exercising the option.

As indicated above, the remote master control system 262 may monitor conditions in addition to the constraints set forth in power option data received from the power entity 1140. Particularly, the remote master control system 262 may monitor and analyze a set of conditions (including the power option data) to determine strategies for assigning, transferring, and otherwise managing computational operations using the one or more datacenters 1102-1106. The determined strategies may enable efficient operation by the datacenters while also ensuring that the datacenters operate at target power consumption levels that meet or exceed the minimum power thresholds set forth within one or more power option agreements.

Example monitored conditions include, but are not limited to, power availability 1120, power prices 1122, computing systems parameters 1124, cryptocurrency prices 1126, computational operation parameters 1128, and weather conditions 1129. Power availability 1120 may include determining power consumption ranges at a set of computing systems and/or at one or more datacenters. In addition, power availability 1120 may also involve determining the source or sources of power available at a datacenter. For instance, the remote master control system 262 may identify the types of power sources (e.g., BTM, grid

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power, and/or a battery system) that a datacenter has available. Power prices 1122 may involve an analysis of the different costs associated with powering a set of computing systems. For instance, the remote master control system 262 may determine cost of power from the grid without a power option agreement relative to the cost power from the grid under the power option agreement. In addition, the remote master control system 262 may also compare the cost of grid power relative to the cost of BTM power when available at a datacenter. The power prices 1122 may also involve comparing the cost of using power at different datacenters to determine which datacenter may perform computational operations at a lower cost.

Monitoring computing system parameters 1124 may involve determining parameters related to the computing systems at one or more datacenters. For instance, the remote master control system 262 may monitor various parameters of the computing systems at a datacenter, such as the abilities and availability of various computing systems, the status of the queue used to store computational operations awaiting performance by the computing systems. The remote master control system 262 may determine types and operation modes of the computing systems, including which computing systems could operate in different modes (e.g., a higher power or a lower power mode) and/or at different hash rates and/or frequencies. The remote master control system 262 may also estimate when computing systems may complete current computational operations and/or how many computational operations are assigned to computing systems.

Monitoring cryptocurrency prices 1126 may involve monitoring the current price of one or more cryptocurrencies, the hash rate and/or estimated power consumption associated with mining each cryptocurrency, and other factors associated with the cryptocurrencies. The remote master control system 262 may use data related to monitoring cryptocurrency prices 1126 to determine whether using computing systems to mine a cryptocurrency generates more revenue than the cost of power required for performance of the mining operations.

The remote master control system 262 may monitor parameters related to computational operations (e.g., computational operation parameters 1128). For example, the remote master control system 262 may monitor parameters related to the computational operations requiring performance and currently being performed, such quantity of operations, estimated time to complete, cost to perform each computational operation, deadlines and priorities associated with each computational operation. In addition, the remote master control system 262 may analyze computational operations to determine if a particular type of computing system may perform the computational operation better than other types of computing systems.

Monitoring weather conditions 1129 may include monitoring for any potential power generation disruption due to emergencies or other events, and changes in temperatures or weather conditions at power generators or datacenters that could affect power generation. As such, the operations and environment analysis module (or another component) of the remote master control system 262 may be configured to monitor one or more conditions described above.

The performance strategy determined by the remote master control system 262 based on the monitored conditions and/or power option data can include control instructions for the load (e.g., the datacenters and/or one or more sets of computing systems). For instance, a performance strategy can specify operating parameters, such as operating frequen-



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cies, power consumption targets, operating modes, power on/off and/or standby states, and other operation aspects for computing systems at a datacenter.

The performance strategy can also involve aspects related to the assignment, transfer, and performance of computational operations at the computing systems. For instance, the performance strategy may specify computational operations to be performed at the computing systems, an order for completing computational operations based on priorities associated with the computational operations, and an identification of which computing systems should perform which computational operations. In some instances, priorities may depend on revenue associated with completing each computational operation and deadlines for each computational operation.

The monitored conditions may enable efficient distribution and performance of computational operations among computing systems at one or more datacenters (e.g., datacenters 1102-1106) in ways that can reduce costs and/or time to perform computational operations, take advantage of availability and abilities of computing systems at the datacenters 1102-1106, and/or take advantage in changes in the cost for power at the datacenters 1102-1106. In addition, the monitored conditions may also involve consideration of the power option data to ensure that the computing systems consume enough power to meet minimum power thresholds set forth in one or more power option agreements.

The various monitored conditions described above as well as other potential conditions may change dynamically and with great frequency. Thus, to enable efficient distribution and performance of the computational operations at the datacenters, the remote master control system 262 may be configured to monitor changes in the various conditions to assist with the efficient management and operations of the computing systems at each datacenter. For instance, the remote master control system 262 may engage in wired or wireless communication 1130 with datacenter control systems (e.g., datacenter control system 504) at each datacenter as well as other sources (e.g., the power entity 1140) to monitor for changes in the conditions.

The remote master control system 262 may analyze the different conditions in real-time to modulate operating attributes of computing systems at one or more of the datacenters. By using the monitored conditions, the remote master control system 262 may increase revenue, decrease costs, and/or increase performance of computational operations via various modifications, such as transferring computational operations between datacenters or sets of computing systems within a datacenter and adjusting performance at one or more sets of computing systems (e.g., switching to a low power mode).

In some examples, the traditional datacenter 1106 may be the load subject to a power option agreement. As such, the remote master control system 262 may factor the power option agreement when determining whether to perform computational operations using the computing systems 1112 at the traditional datacenter 1106 and/or transfer computational operations to the computing systems 1108, 1110 at the flexible datacenters 1102, 1104. For instance, the monitored conditions may indicate that the price of grid power is substantially higher than BTM power. As a result, the remote master control system 262 may transfer a subset of computational operations from the traditional datacenter 1106 to the flexible datacenters 1102, 1104. The traditional datacenter 1106 may still have some computational operations to perform to ensure that the traditional datacenter 1106 is

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using enough power to meet the minimum power threshold or thresholds set forth in the power option agreement.

In some examples, the remote master control system 262 may monitor the grid frequency signal received from the power entity 1140. When the frequency of the grid deviates a threshold amount (e.g., 0.036 Hz above or below 60 Hz), the remote master control system 262 may adjust performance strategies at the load. In some cases, the remote master control system 262 may adjust the power consumption at the load, the number of miners (or computing systems) operating at the load, and/or the frequency or hash rate, among other possible changes. The remote master control system may readjust performance strategies at the load in response to receiving additional power option data from the power entity 1140 (e.g., an indication that the frequency of the grid is back to 60 Hz). In addition, the remote master control system 262 may communicate changes in operations at the load to the power entity 1140. This way, the power entity 1140 may obtain confirmation that the load is adjusting in accordance with a power option agreement.

In some embodiments, a power generation source (e.g., the generation station 400 shown in FIG. 4) may enter into a power option agreement with a grid operator, which may provide the grid operator with the option to reduce the amount of power that the power source generator can deliver to the grid during a defined time interval. For instance, a wind generation farm may enter into the power option agreement with the grid operator. In addition, the remote master control system 262 may also enter into a power option agreement with the power generation source (e.g., the wind farm) to provide a load that can receive excess power from the power generation source when the grid operator exercises the option and lowers the amount of power that the power generation source can deliver to the grid. Thus, rather than reducing the amount of power produced, the power generation source could exercise an option in the agreement with remote master control system 262 and redirect excess power to one or more loads (e.g., a set of computing systems) that could ramp up power consumption in response. In such situations, the remote master control system 262 may be able to use the excess power from the power generation source (e.g., BTM power) to perform operations at one or more loads at a low cost (or no cost at all). In addition, the power generation source may benefit from the power option agreement by directing excess power to the load instead of temporarily halting power production.

In some examples, a power option agreement may depend on parameters associated with balancing grid capacity and demand. For instance, power option agreements may incentivize power consumption ramping during periods of peak grid power use.

FIG. 12 shows a graph representing power option data based on a power option agreement, according to one or more embodiments. The graph 1200 shows power option data arranged according to power 1204 over time 1202. As shown in FIG. 12, time 1202 increases along the X-axis and minimum power thresholds 1204 increase along the Y-axis of the graph 1200. In the example embodiment shown in FIG. 12, the time 1202 increases up to a full day (e.g., 24 hours) in 4 hour increments and the power is shown in MW increasing in intervals of 5 MW. The 24 duration and example minimum power thresholds can differ in other embodiments. Particularly, these values may depend on the terms set forth within the power option agreement.

The graph line 1206 represents sets of minimum power thresholds 1206A, 1206B, 1206C that are specified by

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power option data based on the power option agreement. As shown, the graph line **1206** extends the entire 24 hour duration, which indicates that the set of time intervals associated with minimum power thresholds add up to 24 hours. In other examples, the power option agreement may not include a minimum power threshold during a portion of the duration.

The graph line **1206** of the graph **1200** is further used to illustrate power consumption levels that one or more loads (e.g., a set of computing systems) operating according to the power option agreement may utilize during the 24 hour duration. Particularly, the power quantities above the graph line **1206** represents power levels that the load(s) may consume from the power grid during the 24 hour duration that would satisfy the requirements (i.e., the minimum power thresholds **1206A-1206C**) set forth by the power option agreement. In particular, the power quantities above the graph line **1206** include any power quantity that meets or exceeds the minimum power threshold at that time. By extension, the power quantities positioned below the graph line **1206** represents the amount of power that the load could be directed to reduce power consumption by per the power option agreement.

To further illustrate, an initial minimum power threshold **1206A** is shown associated with the time interval starting at hour 0 and extending to hour 8. In particular, the minimum power threshold **1206A** is set at 5 MW during this time interval. Thus, based on the power option data shown in FIG. **12**, the loads must be able to operate at a target power consumption level that is equal to or greater than the 5 MW minimum power threshold **1206A** at all times during the time interval extending from hour 0 to hour 8, in order to be able to satisfy the power option if it is exercised for that time interval. Similarly, the power entity could reduce the power consumed by loads by any amount up to 5 MW at any point during the time interval from hour 0 to hour 8 in accordance with the power option agreement. For instance, the power entity could exercise its option at any point during this time interval to reduce the power consumed by the loads by 3 MW as a way to load balance the power grid. In response to the power entity exercising its option, the load may then operate using 3 MW less power and/or another strategy determined by a control system factoring additional conditions (e.g., the price of grid power, the revenue that could be generated from mining a cryptocurrency, and/or parameters associated with computational operations awaiting performance).

As further shown in the graph **1200** illustrated in FIG. **12**, the next minimum power threshold **1206B** is associated with the following time interval, which starts at hour 8 and extends until hour 16. During this time interval (hour 8 to hour 16), the load(s) may consume 10 MW or more power since the minimum power threshold **1206B** is now set at 10 MW as shown on the Y-axis of the graph **1200**. In light of the power option data, a control system may determine and provide a performance strategy to the load (e.g., a set of computing systems) that includes a power consumption target that meets or exceeds the minimum power threshold **1206B** (i.e., 10 MW). The performance strategy may depend on the power option data as well as other possible conditions, such as the price of grid power, the availability of computing systems, and/or the type of computing operations, etc. In addition, the power entity could exercise its option to reduce the amount of power consumed by the load by 10 MW or less as represented by the power levels under the minimum threshold **1206B** that extend during the time interval of hour 8 to hour 16.

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The last minimum power threshold **1206C** is associated with the time interval that starts at hour 16 and extends until hour 24. Similar to the initial minimum power threshold **1206A** associated with the beginning of the graph line **1206**, the last minimum power threshold **1206** is also set at 5 MW. As such, at any point during this interval (hour 16 to hour 24) the loads may consume 5 MW or more to operate in accordance with the power option agreement. As discussed above, by operating at 5 MW or more, the load enables the power consumed from the power grid to be reduced any amount from zero up to 5 MW during this time interval.

When determining the power consumption strategy for a load, a computing system (e.g., the remote master control system **262**) may consider various conditions in addition to the power option data received based on one or more power option agreements. Particularly, the computing system may consider and weigh different conditions in addition to the power option data to determine power consumption targets and/or other control instructions for a load. The conditions may include, but are not limited to, the price of grid power, the price of alternative power sources (e.g., BTM power, stored energy), the revenue associated with mining for one or more cryptocurrencies, parameters related to the computational operations requiring performance (e.g., priorities, deadlines, status of the queue organizing the operations, and/or revenue associated with completing each computational operation), parameters related to the set of computing systems (e.g., types and availabilities of computing systems), and other conditions (e.g., penalties if a minimum power threshold is not met and/or monetary benefits from operating under a power option agreement). By weighing various conditions, the computing system may efficiently manage the set of computing systems, including enabling performance of computational operations cost effectively and/or ensuring at that computing systems operate at target power consumption levels that one or more satisfy power option agreements.

In some examples, the computing system may decrease the amount of power that a set of computing systems consumes from one source and while also increasing the amount of power that the set consumes from another source. For instance, the computing system may determine that the price of power grid power is above a threshold price that makes computational operations relatively expensive to perform using grid power. As a result, the computing system may provide control instructions for the computing systems to consume power grid power that matches a minimum power threshold specified by power option data. This may enable the computing systems to satisfy the power option agreement while also avoiding using pricey grid power beyond the minimum amount required per the power option data. In addition, the computing system may instruct some computing systems to switch to a low power mode or temporarily stop until the price of power from the grid decreases. The computing system may instruct one or more computing systems to operate using power from another source (e.g., BTM power and/or stored energy from a battery system) and/or transfer one or more computational operations to another set of computing systems (e.g., a different datacenter).

When the power option agreement is a fixed duration power option agreement, the computing system may receive an indication of all the minimum power thresholds **1206A-1206C** and an indication of the associated time interval altogether and in advance of the duration associated with the power option agreement. By providing all of the minimum power thresholds **1206A-1206C** and the time intervals in



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advance, the computing system may determine a performance strategy for the load that can extend across the entire duration. Particularly, the computing system may factor the minimum power thresholds and associated time intervals as well as other monitored conditions to determine the performance strategy for the total duration. This can enable the computing system to accept and assign computational operations to computing systems in advance while also using a performance strategy that meets the expectations of a power option agreement.

In some examples, the performance strategy determined by the computing system may include control instructions for the set of computing systems to execute if a power option is exercised. For instance, the performance strategy may specify different power consumption targets for the computing systems that depend on whether a power option is exercised during each time interval.

In some instances, the computing system may modify the performance strategy when one or more conditions change enough to warrant a modification. For instance, the computing system may receive an indication of a change in a minimum power threshold (e.g., a decrease in the minimum power threshold) and determine one or more modifications based on the new minimum power threshold and/or other conditions (e.g., a change in the price of power).

In other examples, the power option agreement may be a dynamic power option agreement. Particularly, the load may be subject to a changing minimum power threshold that can vary during a predefined duration associated with the power option agreement. For example, a dynamic power option agreement may specify that the load is subject to a minimum power threshold that may vary from 0 MW up to 5 MW during the next 24 hours and the particular minimum threshold for each hour may depend on power option data received from the power entity during the prior hour. The dynamic power option agreement may further specify the expected response time from the load. For instance, the power option agreement may indicate that an indication of a new minimum power threshold will be provided an hour prior to the start of the minimum power threshold. The computing system, for example, may receive an indication at hour 7 about the increase in the minimum power threshold **1206B** starting at hour 8. The indication may (or may not) specify the total time interval associated with a new minimum power threshold. For instance, the indication received by the computing system may specify that the 10 MW minimum power threshold **1206B** extends from hour 8 until hour 16. In other instances, the power option data may indicate that the computing system should abide by the new minimum power threshold until receiving further power option data indicating a change to another new minimum power threshold.

In some examples, the power option data may arrive at the computing system in an unknown order from the power entity with expectations of swift power consumption adjustments by the load. As a result, the power option agreement may require fast ramping of the load to meet changes. Ramping may involve ramping up or down power consumption as well as ramping operating techniques (e.g., adjusting frequency or operation mode).

In some embodiments, the type of power option power agreement may depend on the delivery and content of power option data provided to the load (or a control system controlling the load). For instance, a computing system may receive minimum power thresholds set across an entire duration associated with a power option agreement in advance when the power option agreement is a fixed-

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duration power option agreement. In other instances, the computing system may receive power option data dynamically and adjust operations in real-time (or near real-time). For instance, the computing system may receive a series of power option data that each specifies minimum power threshold changes during the duration set forth in the dynamic power option agreement. To illustrate an example, the computing system may receive power option data during hour 1 that specifies the minimum power threshold for hour 2, power option data during hour 2 that specifies the minimum power threshold for hour 3, and so on across the duration of the dynamic power option agreement.

In some examples, the minimum power threshold for a time interval may be zero during the duration of a power option agreement. As such, the load may use any amount of power from the power grid in accordance with the power option agreement, including no power at all during this time interval. When the price for power is high during this time frame, the load may ramp down power usage to zero MW to avoid paying the high price for power while still being in compliance with the power option agreement.

FIG. 13 illustrates a method for implementing control strategies based on a fixed-duration power option agreement, according to one or more embodiments. The method **1300** serves as an example and may include other steps within other embodiments. A control system (e.g., the remote master control system **262**) may be configured to perform one or more steps of the method **1300**. As such, the control system may take various forms of a computing system, such as a mobile computing device, a wearable computing device, a network of computing systems, etc.

At step **1302**, the method **1300** involves monitoring a set of conditions. For instance, a computing system (e.g., a control system) may monitor various conditions that could impact the performance of operations at one or more loads, including the power consumption targets at the loads. The set of monitored conditions may include a variety of information obtained from one or more external sources, such as one or more datacenters, databases, power generation stations, or types of sources.

Some example conditions include, but are not limited to, the price of grid power, the price and availability of alternative power options (e.g. BTM power, and/or stored energy), parameters of the load (e.g., ramping abilities, type of computing systems, operation modes, etc.), parameters of tasks to be performed using the power at the load (e.g., types, deadlines, priorities, and/or revenue associated with computational operations), availability of other computing systems and their associated costs, and/or revenue associated with mining a cryptocurrency. The computing system may monitor one or more of these conditions as well as others.

At step **1304**, the method **1300** involves receiving power option data based, at least in part, on a power option agreement. As discussed above, the computing system (e.g., a remote master control system) may engage in a power option agreement with a power entity. As a result, the computing system may control a load (e.g., a set of computing systems) in accordance with power thresholds and time intervals received from the power entity based on the power option agreement.

In some examples, the power option data may specify a set of minimum power thresholds and a set of time intervals. Each minimum power threshold in the set of minimum power thresholds may be associated with a time interval in the set of time intervals. To illustrate an example, the power option data may specify a first minimum power threshold



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associated with a first time interval and a second minimum power threshold associated with a second time interval, with the second time interval subsequent to the first time interval.

The set of time intervals may add up to the duration represented by the power option agreement. For instance, the total duration of the set of time intervals may correspond to a twenty-four hour period (e.g., the next day). In other examples, the power option agreement may span across a different duration (e.g., 12 hours). In additional embodiments, the power option data may specify other information, such as monetary incentives associated with parameters of the power option agreement and/or one or more maximum power thresholds.

At step 1306, the method 1300 involves determining a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions. The performance strategy may be determined responsive to receiving the power option data. In addition, the performance strategy may include a power consumption target for the set of computing systems for each time interval in the set of time intervals. In some examples, each power consumption target is equal to or greater than the minimum power threshold associated with each time interval.

As an example, the performance strategy may specify a first power consumption target for the set of computing systems for a first time interval such that the first power consumption target is equal to or greater than a first minimum power threshold associated with the first time interval and a second power consumption target for the set for a second time interval in a similar manner (i.e., the second power consumption target is equal to or greater than a second minimum power threshold).

In some examples, the performance strategy may include an sequence for the set of computing systems to follow when performing computational operations. The sequence, for example, may be based on priorities associated with the computational operations. In addition, the performance strategy may include one or more power consumption targets that are greater than the minimum power thresholds when the price of power from the power grid is below a threshold price during the time intervals associated with the minimum power thresholds.

The performance strategy may also involve transferring, delaying, or adjusting one or more computational operations performed at the set of computing systems. In addition, the performance strategy may involve adjusting operations at the computing systems. For instance, one or more computing systems may switch modes (e.g., operate at a higher frequency or switch to a low power mode).

In addition, the performance strategy may also specify power consumption targets for the set of computing systems to use if the power option is exercised during an interval. This way, the computing systems may continue to perform computational operations (or suspend performance) based on the power option being exercised.

At step 1308, the method 1300 involves providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy. For example, the set of computing systems may operate according to the performance strategy to ensure that the minimum power thresholds are met during the defined time intervals based on the power option agreement.

Some examples may further involve receiving subsequent power option data based, at least in part, on the power option agreement. The subsequent power option data may specify to decrease one or more minimum power thresholds of the

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set of power thresholds. Responsive to receiving the subsequent power option data, the performance strategy for the set of computing systems may be modified based on a combination of at least a portion of the subsequent power option data and one or more conditions of the monitored conditions. The modified performance strategy may include one or more reduced power consumption targets for the set of computing systems. The amount of the reduction in a power consumption target may depend linearly with the amount that the corresponding minimum power threshold was reduced by. For instance, when a minimum power threshold for a time interval is reduced from 10 MW to 5 MW, the power consumption target for that time interval may be reduced from 10 MW to 5 MW. Instructions may be provided to the set of computing systems to perform computational operations based on the modified performance strategy.

FIG. 14 illustrates a method for implementing control strategies based on a dynamic power option agreement, according to one or more embodiments. The method 1400 serves as an example and may include other steps within other embodiments. Similar to the method 1400, a control system (e.g., the remote master control system 262) may be configured to perform one or more steps of the method 1400. As such, the control system may take various forms of a computing system, such as a mobile computing device, a wearable computing device, a network of computing systems, etc.

At block 1402, the method 1400 involves monitoring a set of conditions. Similar to block 1302 of the method 1300, a computing system may monitor various conditions to determine instructions for controlling a set of computing systems.

At block 1404, the method 1400 involves receiving first power option data based, at least in part, on a power option agreement while monitoring the set of conditions. The first power option data may specify a first minimum power threshold associated with a first time interval. For example, the first power option data may specify a minimum power threshold of 10 MW for the next hour, which may start in an hour or less.

The power option agreement may correspond to a dynamic power option agreement in some examples. When managing a load with respect to a dynamic power option agreement, a computing system may receive power option data specifying changes in minimum power thresholds that a load (e.g., the set of computing systems) may be designated to use in the near term (e.g., the next hour). For example, the computing system may receive power option data during each hour of the duration specified by a power option agreement that indicates a minimum power threshold for the next hour.

At block 1406, the method 1400 involves providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition. The first control instructions may be provided responsive to receiving the first power option data.

The first control instructions may include a first power consumption target for the set of computing systems for the first time interval. Particularly, the first power consumption target may be equal to or greater than the first minimum power threshold associated with the first time interval. For example, the first power consumption target may be greater than the first minimum power threshold when a cost of power from the power grid is below a threshold price during the first time interval. In other instances, the first power consumption target may be equal to the first minimum power



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threshold when the cost of power from the power grid is greater than the threshold price.

In some examples, control instructions may specify a sequence for the computing systems to follow when performing computational operations. The sequence may be based on priorities associated with each computational operation.

The first control instructions may be determined based on a combination of the first power option data, the price of power from the power grid, and parameters associated with computational operations to be performed at the set of computing systems.

In some examples, the first control instructions may involve ramping up or down power consumption at the set of computing systems. The power consumption may be ramped up or down based on the first minimum power threshold and one or more other conditions (e.g., the price of power).

At block 1408, the method 1400 involves receiving second power option data based, at least in part, on the power option agreement while monitoring the set of conditions. The computing system may receive the second power option data subsequent to receiving the first power option data. The second power option data may specify a second minimum power threshold associated with a second time interval. For example, the second minimum power threshold may be 7 MW over the duration of the upcoming hour. In other examples, the second minimum power threshold may differ as shown in FIG. 12.

In some instances, the computing system may receive the second power option data during the first time interval such that the second time interval overlaps the first time interval. For instance, the computing system may receive the second power option data to enable real-time adjustments to be made to the power consumed at the set of computing systems.

At block 1410, the method 1400 involves providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power option data and at least one condition. The second control instructions may be provided responsive to receiving the second power option data. The second control instructions may specify a second power consumption target for the set of computing systems for the second time interval. The second power consumption target may be equal to or greater than the second minimum power threshold associated with the second time interval.

In some examples, the computing system may provide a request to a QSE to determine the power option agreement. As such, the computing system may receive power option data (e.g., the first and second power option data) in response to providing the request to the QSE.

The computing system may monitor the price of power from the power grid, and the global mining hash rate and a price for a cryptocurrency (e.g., Bitcoin), among other conditions. The computing system may determine control instructions (e.g., the first and/or second control instructions) based on a combination of power option data, the price of power from the power grid, and the global mining hash rate and the price for the cryptocurrency. For instance, the computing system may cause one or more computing systems (e.g., a subset of computing systems) to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

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Advantages of one or more embodiments of the present invention may include one or more of the following:

One or more embodiments of the present invention provides a green solution to two prominent problems: the exponential increase in power required for growing blockchain operations and the unutilized and typically wasted energy generated from renewable energy sources.

One or more embodiments of the present invention allows for the rapid deployment of mobile datacenters to local stations. The mobile datacenters may be deployed on site, near the source of power generation, and receive low cost or unutilized power behind-the-meter when it is available.

One or more embodiments of the present invention provide the use of a queue system to organize computational operations and enable efficient distribution of the computational operations across multiple datacenters.

One or more embodiments of the present invention enable datacenters to access and obtain computational operations organized by a queue system.

One or more embodiments of the present invention allows for the power delivery to the datacenter to be modulated based on conditions or an operational directive received from the local station or the grid operator.

One or more embodiments of the present invention may dynamically adjust power consumption by ramping-up, ramping-down, or adjusting the power consumption of one or more computing systems within the flexible datacenter.

One or more embodiments of the present invention may be powered by behind-the-meter power that is free from transmission and distribution costs. As such, the flexible datacenter may perform computational operations, such as distributed computing processes, with little to no energy cost.

One or more embodiments of the present invention provides a number of benefits to the hosting local station. The local station may use the flexible datacenter to adjust a load, provide a power factor correction, to offload power, or operate in a manner that invokes a production tax credit and/or generates incremental revenue.

One or more embodiments of the present invention allows for continued shunting of behind-the-meter power into a storage solution when a flexible datacenter cannot fully utilize excess generated behind-the-meter power.

One or more embodiments of the present invention allows for continued use of stored behind-the-meter power when a flexible datacenter can be operational but there is not an excess of generated behind-the-meter power.

One or more embodiments of the present invention allows for management and distribution of computational operations at computing systems across a fleet of datacenters such that the performance of the computational operations take advantages of increased efficiency and decreased costs.

It will also be recognized by the skilled worker that, in addition to improved efficiencies in controlling power delivery from intermittent generation sources, such as wind farms and solar panel arrays, to regulated power grids, the invention provides more economically efficient control and stability of such power grids in the implementation of the technical features as set forth herein.

While the present invention has been described with respect to the above-noted embodiments, those skilled in the art, having the benefit of this disclosure, will recognize that other embodiments may be devised that are within the scope of the invention as disclosed herein. Accordingly, the scope of the invention should be limited only by the appended claims.



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What is claimed is:

1. A system comprising:

a set of computing systems, wherein the set of computing systems is configured to perform computational operations using power from a power grid;

a control system configured to:  
monitor a set of conditions;

receive power option data based, at least in part, on a power option agreement, wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;

responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions, wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and

provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.

2. The system of claim 1, wherein the control system is configured to monitor the set of conditions comprising:

a price of power from the power grid; and

a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems.

3. The system of claim 2, wherein the control system is configured to:

determine the performance strategy for the set of computing systems based on a combination of at least the power option data, the price of power from the power grid, and the plurality of parameters associated with the one or more computational operations.

4. The system of claim 3, wherein the performance strategy further comprises:

an order for the set of computing systems to follow when performing the one or more computational operations, wherein the order is based on respective priorities associated with the one or more computational operations.

5. The system of claim 4, wherein the performance strategy further comprises:

at least one power consumption target that is greater than a minimum power threshold when the price of power from the power grid is below a threshold price during the time interval associated with the minimum power threshold.

6. The system of claim 1, wherein the control system is further configured to:

receive subsequent power option data based, at least in part, on the power option agreement, wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds.

7. The system of claim 6, wherein the control system is further configured to:

responsive to receiving the subsequent power option data, modify the performance strategy for the set of computing systems based on a combination of at least the

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portion of the subsequent power option data and at least one condition in the set of conditions,

wherein the modified performance strategy comprises one or more reduced power consumption targets for the set of computing systems.

8. The system of claim 7, wherein the control system is further configured to:

provide instructions to the set of computing systems to perform the one or more computational operations based on the modified performance strategy.

9. The system of claim 1, wherein the control system is a remote master control system positioned remotely from the set of computing systems.

10. The system of claim 1, wherein the control system is a mobile computing device.

11. The system of claim 1, wherein the control system is configured to receive the power option data while monitoring the set of conditions.

12. The system of claim 1, wherein the control system is further configured to:

provide a request to a qualified scheduling entity (QSE) to determine the power option agreement; and  
receive power option data in response to providing the request to the QSE.

13. The system of claim 1, wherein the power option data specify: (i) a first minimum power threshold associated with a first time interval in the set of time intervals, and (ii) a second minimum power threshold associated with a second time interval in the set of time intervals,

wherein the second time interval is subsequent to the first time interval.

14. The system of claim 13, wherein the control system is configured to:

determine the performance strategy for the set of computing systems such that the performance strategy comprises:

a first power consumption target for the set of computing systems for the first time interval, wherein the first power consumption target is equal to or greater than the first minimum power threshold; and

a second power consumption target for the set of computing systems for the second time interval, wherein the second power consumption target is equal to or greater than the second minimum power threshold.

15. The system of claim 1, wherein a total duration of the set of time intervals corresponds to a twenty-four hour period.

16. The system of claim 1, wherein the set of conditions monitored by the control system further comprise:

a price of power from the power grid; and  
a global mining hash rate and a price for a cryptocurrency; and

wherein the control system is configured to:

determine the performance strategy for the set of computing systems based on a combination of at the portion of the power option data, the price of power from the power grid, the global mining hash rate and the price for the cryptocurrency,

wherein the performance strategy specifies for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.



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17. A method comprising:  
 monitoring, by a computing system, a set of conditions;  
 receiving, at the computing system, power option data  
 based, at least in part, on a power option agreement,  
 wherein the power option data specify: (i) a set of  
 minimum power thresholds, and (ii) a set of time  
 intervals, wherein each minimum power threshold in  
 the set of minimum power thresholds is associated with  
 a time interval in the set of time intervals;  
 responsive to receiving the power option data, determin-  
 ing a performance strategy for a set of computing  
 systems based on a combination of at least a portion of  
 the power option data and at least one condition in the  
 set of conditions, wherein the performance strategy  
 comprises a power consumption target for the set of  
 computing systems for each time interval in the set of  
 time intervals, wherein each power consumption target  
 is equal to or greater than the minimum power thresh-  
 old associated with each time interval; and  
 providing instructions to the set of computing systems to  
 perform one or more computational operations based  
 on the performance strategy.

18. The method of claim 17, wherein determining the  
 performance strategy for the set of computing systems  
 comprises:

identifying information about the set of computing sys-  
 tems; and  
 determining the performance strategy to further comprise  
 instructions for at least a subset of the set of computing  
 systems to operate at an increased frequency based on  
 a combination of at least the portion of the power  
 option data and the information about the set of com-  
 puting systems.

19. The method of claim 17, further comprising:  
 receiving subsequent power option data based, at least in  
 part, on the power option agreement, wherein the  
 subsequent power option data specify to decrease one  
 or more minimum power thresholds of the set of  
 minimum power thresholds;

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responsive to receiving the subsequent power option data,  
 modifying the performance strategy for the set of  
 computing systems based on a combination of at least  
 the portion of the subsequent power option data and at  
 least one condition in the set of conditions, wherein the  
 modified performance strategy comprises one or more  
 reduced power consumption targets for the set of com-  
 puting systems; and

providing instructions to the set of computing systems to  
 perform the one or more computational operations  
 based on the modified performance strategy.

20. A non-transitory computer readable medium having  
 stored therein instructions executable by one or more pro-  
 cessors to cause a computing system to perform functions  
 comprising:

monitoring a set of conditions;  
 receiving power option data based, at least in part, on a  
 power option agreement, wherein the power option  
 data specify: (i) a set of minimum power thresholds,  
 and (ii) a set of time intervals, wherein each minimum  
 power threshold in the set of minimum power thresh-  
 olds is associated with a time interval in the set of time  
 intervals;

responsive to receiving the power option data, determin-  
 ing a performance strategy for a set of computing  
 systems based on a combination of at least a portion of  
 the power option data and at least one condition in the  
 set of conditions, wherein the performance strategy  
 comprises a power consumption target for the set of  
 computing systems for each time interval in the set of  
 time intervals, wherein each power consumption target  
 is equal to or greater than the minimum power thresh-  
 old associated with each time interval; and

providing instructions to the set of computing systems to  
 perform one or more computational operations based  
 on the performance strategy.

\* \* \* \* \*



FORM 19. Certificate of Compliance with Type-Volume Limitations

Form 19  
July 2020

**UNITED STATES COURT OF APPEALS  
FOR THE FEDERAL CIRCUIT**

**CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATIONS**

**Case Number:** 2023-1922

**Short Case Caption:** BearBox LLC v. Lancium LLC

**Instructions:** When computing a word, line, or page count, you may exclude any items listed as exempted under Fed. R. App. P. 5(c), Fed. R. App. P. 21(d), Fed. R. App. P. 27(d)(2), Fed. R. App. P. 32(f), or Fed. Cir. R. 32(b)(2).

The foregoing filing complies with the relevant type-volume limitation of the Federal Rules of Appellate Procedure and Federal Circuit Rules because it meets one of the following:

- ☒ the filing has been prepared using a proportionally-spaced typeface and includes 13,827 words.
- ☐ the filing has been prepared using a monospaced typeface and includes \_\_\_\_\_ lines of text.
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Date: 08/25/2023

Signature: /s/ Benjamin T. Horton

Name: Benjamin T. Horton